IMPACT ASSESSMENT PAPER

Assessing the Impact

of CIFOR's Influence on Policy and Practice in the Indonesian Pulp and Paper Sector

David A. Raitzer

CIFOR

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Center for International Forestry Research (CIFOR)

CIFOR is a leading international forestry research organisation established in 1993 in response to global concerns about the social, environmental, and economic consequences of forest loss and degradation. CIFOR advances human wellbeing, environmental conservation, and equity by conducting research to inform policies and practices that affect forests in developing countries. CIFOR is one of 15 centres within the Consultative Group on International Agricultural Research (CGIAR). CIFOR's headquarters are in Bogor, Indonesia. It also has offices in Asia, Africa and South America. CIFOR works in over 30 countries worldwide and has links with researchers in 50 international, regional and national organisations.

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List of acronyms

APP	Asia Pulp and Paper
APRIL	Asia Pacific Resources International Holdings Limited
CGI	Consultative Group on Indonesia
CGIAR	Consultative Group on International Agricultural Research
CIFOR	Center for International Forestry Research
CMEC	China National Machinery and Equipment Import and Export Corporation
DFF	Donor Forum on Forests
DFID	Department for International Development
FoE	Friends of the Earth
FoE-A	Friends of the Earth Australia
FoE-EWNI	Friends of the Earth England, Wales and Northern Ireland
FPIC	Free, Prior and Informed Consent
HCVF	high conservation value forest
IBRA	Indonesian Bank Restructuring Agency
IFC	International Finance Corporation
IIED	International Institute for Environment and Development
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPG	international public good
IRR	internal rate of return
IWGFF	Indonesian Working Group on Forest Finance
JIKALAHARI	Jaringan Kerja Penyelamat Hutan Riau (Forest Rescue Network Riau)
LEI	Indonesian Ecolabeling Institute
MIGA	Multilateral Investment Guarantee Agency (World Bank)
MoF	Ministry of Forestry, Indonesia
MoU	Memorandum of Understanding
MRA	Master Restructuring Agreement
NGO	non-governmental organisation
RAPP	Riau Andalan Pulp and Paper
SCBD	Secretariat of the Convention on Biological Diversity
SMG	Sinar Mas Group
SPIA	Standing Panel on Impact Assessment
UFS	United Fibre Systems
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
WALHI	Wahana Lingkungan Hidup Indonesia (the Indonesian Environmental Forum, also known as Friends of the Earth Indonesia)
WWF	World Wide Fund for Nature

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Executive summary

Despite rapidly rising investment in international policy oriented research, there remains considerable uncertainty about its effectiveness as a contributor to development goals. The present study attempts to help resolve this uncertainty by applying a combination of qualitative and quantitative methods to assess the economic impact associated with influence stemming from CIFOR's research on the political economy of the Indonesian pulp and paper sector.

The assessed research revealed how pulp mills had received very large subsidies from the 'reforestation fund', subsidised interest rates were provided by state banks, and forested land was provided at virtually no cost to selected elites with strong connections to the Suharto regime. Poor due diligence and a weak regulatory environment allowed opportunities for the exploitation of information asymmetries, which created incentives for pulp and paper companies to continually expand capacities at their mills. Using the examples of pulp mills owned by Asia Pulp and Paper (APP) and Asia Pacific Resources International Holdings Limited (APRIL), the study illustrated how, once mills were established, plans to establish plantation fibre supplies were not followed, and most fibre was harvested from natural forests for extended periods of time, as the royalties for such fibre were much lower than the cost of plantation-based wood.

This impact assessment used key informant interviews to trace contributions of this research to impact pathways via civil society, government agencies, donor agencies, financial institutions and the Indonesian pulp and paper industry. Document review and time series statistical tests are used to triangulate interview results.

This analysis reveals that the visibility of CIFOR's research and the detailed data provided therein were quickly utilised by WWF, Friends of the Earth and other non-governmental organisations (NGOs) that quickly began

to cite the study's findings in their campaigns. The data in CIFOR's reports allowed the NGOs to successfully approach pulp buyers in Western markets and investors, who began to demand more sustainable practices by APP and APRIL. In response, the companies undertook specific commitments to increase conservation set-asides and accelerated plantation development. As a result of initial campaigns, civil society attention to Indonesian fibre sourcing through natural forest clearance has also helped to avert additional investment in pulp processing capacity lacking plantation-based fibre supplies.

Due in part to this shift in the demands of export markets and investors, the Indonesian Government was compelled to mitigate reliance on natural forest for fibre. Thus, a Ministerial Decree on the 'acceleration of plantation development and pulp and paper industry raw material supply' was adopted, which has been interpreted (in government and industry statements) to require specific improvement in fibre sourcing practices by 2010.

Accelerated plantation development is estimated to offset wood consumption through natural forest clearance, while increased conservation set-asides are projected to slow the rate of clearance of those areas of forests. Reduced growth in overcapacity has reduced consumption of wood from natural forests and thereby averted natural forest clearance. The study estimates that the overall result of these changes has been the averted loss of between 76 000 and 212 000 hectares of natural forest, depending on assumptions applied, with 135 000 hectares of natural tropical rainforest saved under the main set of assumptions. Much of the savings is in areas of deep moist peat, with more than 1000 tonnes of carbon stored per hectare, and in areas of high biodiversity.

The interviews with representatives of agencies at each major step of each of the principal impact pathways are further used to develop plausible 'counterfactual' scenarios. These interview results suggest counterfactual scenarios of slower adoption of identified improvements in the absence of CIFOR's research.

An economic surplus framework is developed to value averted natural forest clearance based on the external environmental benefits of forest conservation and the avoided consumption of implicit subsidies from underpriced wood royalties. This framework is used in conjunction with the counterfactuals to identify economic benefits attributable to CIFOR. These benefits, which principally result from reduced carbon emissions, are determined to range from $19 million to $583 million, depending on assumptions used, with a main estimate of $133 million (discounted US dollars). In the context of less than half a million dollars of direct research costs, this represents an exceptional return on investment, and illustrates the potential effectiveness of advocacy bodies as an intermediary audience for policy oriented research findings.

1 Introduction

Although technology oriented research in agriculture and other sectors has been extensively documented as an effective contributor to development goals, the impact of policy oriented research is characterised by considerably more uncertainty. Despite dozens of attempts to discern the impact of policy oriented research in the agricultural and natural resource sectors, only a few studies have successfully estimated quantitative measures of research benefits (SPIA 2006; Raitzer and Ryan 2008).

Moreover, broader efforts to identify the impact of policy oriented and social science research have often been unable to successfully identify beneficial policy changes attributable to research. Rather, these studies have frequently concluded that the influences of research are subtle, incremental and indirect, and occur through improvements in the general understanding of issues, rather than direct instrumental effects on decisions (Weiss 1977; Court and Young 2006). This suggests that there are many intermediate steps between research and impact, which create difficulties for attribution, and lengthen lag times to impact from policy oriented research.

Decision theory from political science and psychology also suggests limitations to the ability of research-derived information to make instrumental improvements to policy decisions. Policy-making processes are typically characterised by less than perfect rationality, based on incomplete information acquisition (Janis and Mann 1979). In this context, the consideration of new information that challenges the preconceptions of policy makers is likely to be rather limited.

Despite these suggestions that policy oriented research is likely to have limited efficacy, investment in policy oriented research as a means of achieving development goals is rising, often at the expense of more traditional technology oriented research (Lele *et al.* 2003). Given scarce resources for research, this

raises the question of whether such investment merits the opportunity costs of foregone investment in technology oriented activities. A definitive answer has not been possible previously, due to well documented constraints to the attribution of the policy influence of research-derived information (SPIA 2006; Raitzer and Ryan 2008).

It is also possible that the limited benefits previously attributed to policy oriented research through evaluation studies may be an artefact of the methods applied. In their review of studies of the diffusion, influence and impact of international agricultural policy oriented research, Raitzer and Ryan (2008) find that most prior studies have not been clear about the evidence underlying claims of causal effects of research. The vast majority of studies lack explicit counterfactual scenarios, a cornerstone of good impact assessment practice (Maredia *et al.* 2000), and all but a few have not investigated the benefits or costs of the policy changes identified. Undertakings by other bodies regarding the influence and impact of policy oriented research, such as studies by the Overseas Development Institute on 'Research and Policy in Development' (e.g. Court *et al.* 2005) have had similar methodological limitations. This has arguably constrained their ability to offer conclusive evidence as to the impacts achieved by the policy oriented research assessed to date.

By taking an innovative approach with more attention to rigour, the present case study attempts to offer some evidence towards a resolution of the efficacy of policy oriented research investments. It does so by examining policy oriented research conducted by the Center for International Forestry Research (CIFOR), which influenced a wide array of civil society advocacy concerning fibre sourcing practices of the Indonesian pulp and paper sector, and which thereby indirectly influenced practices and regulation of the sector. The research is a unique case for impact assessment, as the intermediate audience of non-governmental organisations (NGOs) is an unusual target audience for policy oriented research in the natural resources sector. The methodological approach used seeks to ensure that greater transparency and triangulation underlie causal claims than has been the case in many prior studies, and devotes more attention to quantitative analysis of the economic significance of changes attributed to the research through explicit counterfactual scenarios.

1.1 Description of research

CIFOR had an active research programme on 'Underlying Causes of Deforestation' that ran from 1993 to 2003. While other institutes had done research on direct causes of deforestation, this programme was unique in that it focused on analysing extra-sectoral determinants of deforestation outcomes, which had received little emphasis in previous literature on the topic. Case studies of the drivers of deforestation were conducted in Bolivia, Brazil, Cameroon, Ecuador, Gabon, Ghana, Indonesia, Malawi, Mozambique, Papua New Guinea, Tanzania, Venezuela and Zimbabwe. The purpose of the research was to induce 'changes in policies and means for their implementation' by both 'the private sector' and 'governments' (CIFOR 2000).

The case studies had various foci. Some of them focused on analysis of the role and determinants of agricultural expansion as a driver of deforestation. Others focused on the effects of decentralisation, revenue flows from the mining and petroleum sector, and the role of macroeconomic changes in shaping pressures on forests. Case studies in Indonesia initially focused on determinants of deforestation, and particularly the role played by smallholders.

The onset of the Asian financial crisis in 1997–1998 sharply redefined the context for CIFOR's research on the underlying causes of deforestation in Indonesia. In less than 6 months, the Rupiah had lost over 70 per cent of its value, inflation almost doubled, and millions of people were thrust into poverty as the financial sector collapsed. In January 1998, the Government of Indonesia signed a US$ 43 billion loan agreement with the International Monetary Fund (IMF) to help mitigate the financial crisis. In doing so, the Government made commitments to a far-reaching set of policy reforms aimed at recapitalising the country's banking system and restoring long-term economic growth – a process commonly known as structural adjustment. In May 1998, after several weeks of popular protests, President Suharto resigned from office following 32 years in power.

In October 1998, CIFOR hired Christopher Barr to analyse the realised and anticipated effects of structural adjustment on Indonesia's forestry sector. The research initially focused on the forestry-related conditionalities attached to the IMF's loan agreement, which were intended to promote sustainable management of Indonesia's remaining natural forests. Formulated with technical assistance from the World Bank, these included a number of policy reforms principally aimed at raising efficiency levels in the country's timber concession[1] system and plywood industry. Barr's research also analysed two important sources of pressure on the country's forests that the World Bank and IMF had not explicitly assessed: the rapid expansion of Indonesia's pulp and paper industry, and the large amounts of corporate debt associated with the nation's forestry conglomerates.

This increased focus on Indonesia's pulp and paper sector stemmed from a paradox initially identified by Christian Cossalter, then head of CIFOR's Plantations Programme, in mid-1998. Following several years of research on improving the environmental sustainability of silvicultural practices, Cossalter began to observe a perplexing trend: while Indonesia's pulp and paper producers were developing some areas of plantations to feed their pulp mills, the mills were expanding at a faster pace than these plantations were being developed. As a result, it appeared that some of Indonesia's leading producers were soon going to face substantial fibre shortfalls.

[1] A concession is an allocation of rights for extractive resource use. As all Indonesian forest land is owned and administered by the state, the concession system is the legal basis for the conduct of private sector forestry operations. In Indonesia, most pulp plantation concessions are allocated through *Hutan Tanaman Industri* (Industrial Timber Plantations, HTI) licences for 35 years plus the length of one rotation. Allocation systems for concessions were not particularly transparent under the Suharto 'New Order' regime, but have moved towards increasingly open 'auction' systems since Suharto's fall.

Concurrently, the UK Department for International Development (DFID) was funding research that analysed the political economy of rent captured from the forest sector in Indonesia. This research found that the Suharto regime created significant barriers to entry into the forest industry and imperfect competition, so as to generate opportunities for generating rent, which could be used as political reward (Brown 1999). During the same period, Barr also conducted research on similar issues related to the role of state elites and rent capture in Indonesia's timber and plywood industries (Barr 1998).

The research used the Indonesian pulp and paper industry as a concrete illustration of how the forestry sector was rife with imperfect competition, information asymmetries and various forms of subsidies, which resulted in adverse selection of investments that induced natural forest[2] clearance. More specifically, the initial case study of the 'political economy' of the pulp and paper sector revealed and detailed how pulp mills had received very large government subsidies, despite the fact that they carried a great deal of financial risk. Cash subsidies were received from the 'reforestation fund', subsidised interest rates were provided by state banks, and forested land was provided at virtually no cost to selected elites with strong connections to the Suharto regime. Risk guarantees leveraged additional funding from national and international investors. Poor due diligence and a weak regulatory environment provided opportunities for the exploitation of information asymmetries. Pulp mill owners inflated investment costs to siphon a portion of funds from government subsidies. In turn, this created structural incentives for pulp and paper companies to continually expand the capacities of their mills, as they often made substantial profits on the financing of such projects and the subsidies involved. The analysis provided data that documented how, once mills were established, repeatedly stated plans to establish plantation-based fibre supplies were not followed, and most fibre continued to be harvested from natural forests for extended periods of time, using example cases of Asia Pulp and Paper (APP[3]) and Asia Pacific Resources International Limited Holdings (APRIL[4]).

To help mitigate these trends, selected key 'policy options' identified by the study included the following (Barr 2001):

1. *A moratorium on new pulp and paper processing capacity expansions in Indonesia until full and public audits of the companies' pulp wood supply plans are carried out.*

[2] The internationally accepted definition of 'natural forest' as 'a forest composed of indigenous trees and not classified as forest plantation' (FAO 2004) is used in this study.

[3] For simplicity, APP is used to refer not only to the company, but also its forestry related affiliates under similar ownership, including other parts of the Sinar Mas Group, such as Sinar Mas Forestry.

[4] For simplicity, APRIL is used to refer not only to the company, but also its forestry related affiliates under similar ownership, including other parts of the Raja Garuda Mas Group.

2. *Elimination of the wood supply subsidy to Indonesia's pulp industry, by raising royalties and fees to reflect the full stumpage value of the wood.*

3. *Enforcement of the Indonesian Government's 1998 moratorium on the allocation of new forest conversion licenses, in accordance with the government's existing commitments to the IMF and the Consultative Group on Indonesia. This moratorium could be extended to include restrictions on new harvesting permits for existing forest concessions slated for conversion.*

4. *Introduction of a credible independent monitoring program of plantation development (including the use of aerial or satellite images) and sanctions provided for companies that fail to meet agreed upon sustainability targets.*

5. *Enforcement of improved due diligence practices on the part of financial institutions funding pulp and paper projects, so as to ensure that the financial risks associated with these projects are fully assessed and that financing is not being allocated to projects involved in illegal practices, including use of illegally obtained raw materials.*

The Barr (2001) study also identified options for linking resolution of debt absorbed by government entities after the Asian Financial Crisis to industry restructuring, so as to reduce processing overcapacity. The recommended approach was to close highly indebted industries that lacked viable plans to develop sustainable fibre supplies.

The research was initially conduced under financing from DFID and the World Wide Fund for Nature (WWF), which also helped to disseminate the findings. The methods applied were somewhat unconventional, as many of the key data regarding the pulp industry were not publicly accessible. Moreover, discussion of corruption and illicit business practices had only been recently tolerated in Indonesia after the fall of Suharto's New Order regime in 1998, so the pulp industries had theretofore been able to avoid public scrutiny of their practices. Thus, prior to the release of CIFOR's case study, no independent researcher had been able to amass quantitative evidence of the economic performance and viability of the pulp industry. This made the research unique.

The first output from this line of research was a paper entitled 'Profits on paper: the political economy of fibre, finance and debt in Indonesia's pulp and paper industries', and it was released with a summary via the Bloomberg newswire in November 2000 (Barr 2000). Followon media work included three articles in *The Asian Wall Street Journal*, including an 'Opinion-editorial' piece published on 12 September 2001, as well as cover page articles in *The International Herald Tribune*. In September 2001, CIFOR and WWF also published the initial results along with complementary chapters on the broader effects of structural

adjustment in Indonesia's forestry sector in a more substantive book entitled *Banking on Sustainability: Structural Adjustment and Forestry Reform in Post-Suharto Indonesia* (Barr 2001).

The research findings were communicated via a variety of policy relevant media. More than a dozen articles in financial and popular media, such as the Bloomberg newswire, *The Asian Wall Street Journal*, *The International Herald Tribune* and *The Far Eastern Economic Review* reproduced the study's findings. Dissemination activities continued over the years that followed, with presentations at 28 seminars and conferences in 10 countries. These included donor fora, pulp industry meetings, finance industry meetings, academic seminars and media events.

While dissemination activities continued, substantive research on the pulp sector occurred only intermittently after 2001, as the principal focus of research shifted to analysis of the potential effects of growing demand for wood in China. In 2003, CIFOR was commissioned to review analyses of the potential environmental and social effects of a planned new pulp mill in Indonesia's South Kalimantan province, which ultimately resulted in a 'brief' published in 2005 (Jurgens *et al.* 2005). In 2005, a consultant financial analyst conducted a global analysis of due diligence processes for pulp mill finance, which was released in 2006 (Spek 2006). During the period 2004–2006, a French PhD student hosted by CIFOR analysed timber prices received by local communities from APP, the effects of APP's ownership structure on corporate behaviour, and the viability of fibre sourcing from independently owned plantations in Kalimantan. These studies were published during 2006 and 2007 (Pirard and Rokhim 2006; Pirard and Irland 2007; Pirard and Cossalter 2007).

The present analysis focuses principally on the initial research conducted by CIFOR, as insufficient time has passed for influence and impact from the more recent research to be evident. However, outputs produced between 2000 and 2005 are essentially complementary, as this includes the initial research during 1998 to 2001, dissemination activities from 2000 onwards, and followup analysis of a potential cause of further increase to overcapacity identified in the initial studies. Thus, this assessment focuses on research resulting in outputs and communications products produced between 2000 and 2005. The specific costs of this research and outreach were relatively low, as it consisted of desk studies based on secondary data sources and key informant interviews, and never exceeded one full-time equivalent of international scientific staff time per year.[5]

[5] The costs of the research are discussed in detail in Section 9.1.2.

2 Methodological approach

There are no well-established methods for assessing the impact of policy oriented research (Pardey and Smith 2004), although the methodological challenges that such assessment poses could be contended to be comparatively better documented. The present case study takes an iterative approach to identify prospective channels of influence, assess the importance of CIFOR's contributions, establish plausible counterfactuals (what would have happened in the absence of CIFOR's research), and identify attributable impact.

2.1 Developing an impact 'hypothesis'

The principal investigator worked with project staff to identify perceived impacts of the project. This process began by identifying the most important policy changes related to poverty and environmental goals to which the project is perceived to have contributed. Subsequently, the intermediate pathways by which the research is believed to have influenced the policies were identified, in terms of specific intermediate agencies and interest groups. This was visualised in a series of increasingly detailed 'impact pathway' diagrams.

These initial impact pathways were followed by two additional exercises with project staff. First, the impact pathways were taken further, so as to better characterise the mission-relevant impacts of identified policy changes. Second, key individuals influenced by the research were identified for each intermediate agency in the identified impact pathways.

2.2 Constructing appropriate counterfactuals

The 'impact hypothesis' identified in step one is only an internal perception of influence, which may be inaccurate or biased for a number of reasons.

Moreover, it contains few insights into alternative causes of the policy responses observed, and provides inadequate understanding to identify likely events in the absence of the research (the counterfactual).

Thus, it is important to explore each step in the impact pathway further. Given that there are no objective indices for the influence of information on policy decisions, a qualitative key informant interview approach is necessary to explore the information considered by key individuals involved in the impact pathways (SPIA 2006; Raitzer and Ryan 2008). These interviews were generally conducted in the sequence of the impact pathway, with direct users of the research interviewed first, followed by those who have been influenced by the users.

In total, 31 key informant interviews were conducted between February and October 2007, with representatives of 16 distinct organisations. These informants comprised 11 representatives from an assortment of four NGO groups involved in advocacy over the Indonesian pulp and paper sector, 10 officials involved with international financial institutions, three informants from private sector financial institutions, two key Indonesian Ministry of Forestry officials, three representatives drawn from the two major Indonesian pulp and paper companies, and two independent academics (a full list of interviewees is given in Annex I). The duration of interviews ranged from 30 minutes to 3 hours, with an average length of approximately 75 minutes. Twenty-two of the interviews were conducted in person, while nine were conducted over the telephone.

These interviews relied on semistructured techniques, in which the general topics to be queried were predetermined, but the precise phrasing and the level of follow up were adapted to the individual interviewee, as per the context, and previous responses to questions. Interviews generally began with an explanation of the study, its objectives and the role of the principal investigator. This was followed by a series of questions about the course of events, information use and causal connections. The following topics were sequentially queried in each interview:

1. ***The general chronology of advocacy and policy response***
   The interview began with discussion of the sequence of the key informant's interventions, overall involvement with the topic, and interests and motivations for involvement.

2. ***Policy responses attributable to the informant's agency's actions***
   The interview continued with a query of the consequences of interventions by the informant and/or colleagues. The interview then proceeded to query policy responses identified in the impact pathways, in terms of perceived importance, and whether responses are attributable to the informant's intervention.

3. Reliance on CIFOR's research for the informant's agency's actions
Subsequently, the interview attempted to ascertain the degree to which research findings from CIFOR were embedded in the interviewee's actions, and whether the research enabled the action to occur. This was based on direct queries on the use of CIFOR's findings.

4. Possible substitute sources of information and counterfactual scenarios
Finally, informants were queried about whether and when the actions pursued would have been possible in the absence of CIFOR's work, so as to establish the basis for plausible counterfactual scenarios. Where alternative sources of information were not available, informants were asked about the time required for a substitute to be generated, and what this would imply for the course of events pursued.

As an additional measure to ensure the accuracy of the transcription and analysis of interview results, each informant was provided in July 2008 (via email) with the content of Section 5 that summarises his or her interview, and factual corrections were solicited. In response, four respondents provided minor corrections, which have been addressed in the version presented in this document.

2.3 Assessing overall changes

Data on trends in forestry sector performance were assembled, so as to identify changes that might have been influenced, and to prioritise pathways for the assessment of influence. The present analysis assesses changes in conservation set-aside rates, so as to identify specific areas of forest that have been conserved as a result of conservation commitments. It also assesses changes in plantation establishment rates, so as to identify natural forest clearance that may have been averted, as Indonesian pulp and paper companies developed more sustainable fibre supplies. As the specifics of the calculations can be most effectively described after the interview results, they are presented in detail in Sections 7 and 8.

2.4 Attributing the contribution of research to impact

Any impact assessment has to confront the issue of attribution, or the establishment of causal connections between the assessed intervention and outcomes of interest. For policy oriented research, this is no simple matter, due to three principal problems:

1. The protracted nature of impact pathways
2. That influence is often partial
3. That indices of influence are necessarily subjective.

Policy oriented research often has an immediate audience of advocates and research peers. The intended users of research findings, who are often senior government officials, often only become aware of findings once a wide enough pool of intermediate users builds upon or communicates the results, so that the issue has salience among interest groups (Shulock 1999). To do so may require many sequential intermediate adoption events, as political momentum and 'advocacy coalitions' build around the topic (Jenkins-Smith and Sabatier 1993). Tracing out a protracted series of linkages to policy influence may be particularly challenging, as there may often not be any clear indication or knowledge of the original source of influence among the ultimate users of the research findings. Moreover, the amount of effort invested in advocacy may often dwarf investment in the research. In addition, influence may occur through multiple interdependent pathways, in which a relatively minor contribution spread over a large network may have a large systemic influence. This creates challenges for partitioning credit among the advocacy and research processes, as each contribution may be necessary but insufficient for creating impact.

Many studies have documented the fact that the use of policy oriented research findings does not often reflect full implementation of research recommendations. In fact, policy oriented research use has been observed to include 'symbolic' use, where research is intended to make a decision appear to be based on consideration of relevant information (Leviton and Hughes 1981). In addition, the use of research findings based on accordance with prior beliefs has been frequently observed (Caplan *et al.* 1975; Patton *et al.* 1977; Weiss and Bucuvalas 1977; all cited in Leviton and Boruch 1983).

In addition, influence may not take the form of adoption of a study's recommendations. Rather, when influence occurs, it may motivate a policy response that differs substantially from what scientists may find to be an optimal policy solution. As Sutton (1999) notes, policy making is a process of satisfying political interests, rather than a process of finding optimal solutions to problems. Further compounding these complications is the fact that implemented policy may differ greatly from officially articulated rules.

This creates difficulties for attribution of influence, since the policy response may not fully reflect the research findings, and citation of findings by policy makers may not always be a reliable indication of actual influence. Moreover, partial and potentially varying degrees of influence, adoption and implementation may make benefits somewhat difficult to reliably predict.

For policy oriented research, there is no objective indicator of uptake or influence. As noted above, even explicit citations of research findings may not be reliable indications of influence. Often the only available method to discern whether and how policy oriented research findings are utilised consists of interview and survey techniques. These impart many forms of bias, as respondents may wish to make decisions appear well informed, might be inclined to shift blame for poor policies onto others, or may wish to retain

credit for effective policies. Moreover, an informant may give exaggerated credit, so as to improve relations with the research body or other stakeholders (Nancarrow and Brace 2000).

There is no panacea for these complications. This study attempts to mitigate these constraints through triangulation of interview responses, and by appropriate consideration of the context for responses.

2.5 Use of sensitivity analysis and scenarios

Given the uncertainty associated with attribution and valuation for this case, a range of assumptions is applied to generate plausible economic values attributable to CIFOR's research. For each uncertain parameter there is a main estimate, a conservative estimate and a liberal estimate, which will be used in three scenarios to ascertain the sensitivity of values to the assumptions made.

3 The overall context

Indonesia has one of the world's highest rates of deforestation, with annual losses of about 2.0 million hectares. One major contributor to this trend is wood processing capacity that far outstrips sustainable timber and fibre supply. While plantations provide less than 15 million cubic metres of wood per year, and the 'sustainable yield' from natural production forests is 8–9 million cubic metres, wood processing industries consume 45 million cubic metres annually (World Bank 2006). Approximately half of this is consumed by the pulp and paper sector.

As of late 2007, the Indonesian pulp and paper sector had a total of 6.5 million tonnes of annual pulp production capacity, which is the ninth largest in the world. Two corporate conglomerates dominate the sector, and comprise 70% of installed capacity – Asia Pulp and Paper (APP) and Asia Pacific Resources International Limited Holdings (APRIL). Both companies still state that they rely upon natural forests for at least 50% of their fibre supply (APP 2006; APRIL 2006).

APP is a subsidiary of the Sinar Mas Group, a Singapore-incorporated conglomerate in which the family of Eka Widjaja has a controlling interest. The annual pulp production capacity of APP is 2.5 million tonnes or 40% of the national total. The largest pulp mills of APP include PT Indah Kiat and PT Lontar Papyrus, located in the Riau and Jambi provinces of Sumatra, respectively. The main sources of fibre for pulpwood of APP mills come from forestry plantations of PT Arara Abadi in Riau, PT Wirakarya Sakti in Jambi, as well as an array of 'joint venture' concessions in which APP has partial ownership. Together with its partners, APP's total concession area was 2.3 million hectares in late 2006 (APP 2006).

The second largest pulp and paper company is APRIL, also known as Riau Andalan Pulp and Paper (RAPP), which is a Singapore-incorporated subsidiary of the Raja Garuda Mas Group, an Indonesian conglomerate controlled by

Sukanto Tanoto. The total annual production capacity of APRIL's mill in Riau is about 2 million tonnes of pulp (as of October 2007). In 2006, the company sourced fibre from its 314 000 hectares of Riaufiber concessions, as well as an additional 359 000 hectares of 'joint ventures' (APRIL 2006).

It should be noted that the primary recommended policy response for the Indonesian Government involved forestry industry restructuring, and closure of highly indebted pulp and paper industries that lacked sustainable fibre supplies. This recommendation was ultimately not heeded. Thus, although the policy responses investigated here are believed to be socially beneficial and attributable to some degree to CIFOR's research, they neither represent socially optimal policy nor full implementation of the research recommendations.

3.1 Impact pathways

Hypothetical impact pathways were elicited from CIFOR scientists involved in the research through an extensive series of unstructured interviews. Through this process, three distinct clusters of impact pathways were identified.

Improvements to the sustainability of pulp production practices by APP and APRIL

It was hypothesised that the research attracted the attention of the financial community, which was concerned about the ability of APP, one of the large pulp conglomerates identified in CIFOR's work, to repay outstanding loans. Shortly thereafter, the company and its affiliates defaulted on $14 billion of debt ($6 billion from Indonesian operations), in what was one of the largest defaults in emerging markets. This created substantial international salience regarding the Indonesian pulp and paper sector.

The visibility of the research and the detailed data provided therein were quickly utilised by environmental and community advocacy groups. WWF, Friends of the Earth, Environmental Defense and other NGOs quickly began to cite the study's findings in their campaigns. This credible 'ammunition' allowed the NGOs to have a strengthened negotiating position regarding demands for environmental and social improvements to fibre sourcing practices.

The NGOs used the findings in advocacy campaigns regarding financiers holding APP obligations once it defaulted on its debt. As a result of this advocacy, specific language that prohibits use of illegally harvested logs and requires adherence to environmental sustainability criteria was inserted into the creditors' debt restructuring agreement with the company. As a result, the company increased concession areas devoted to conservation, committed to legal log sourcing, and began to report on environmental performance.

Other campaigns focused on APRIL. As the company was able to restructure most of its debt obligations, the campaigns took other tactics. Friends of the Earth actively challenged the company's reputation, and sought to dissuade foreign purchasers, so as to cause losses in 'prestige markets', while WWF and local NGOs (including Wahana Lingkungan Hidup Indonesia (WALHI) and Jikalahari) actively negotiated with the company. In response, APRIL eventually cooperated with WWF to protect the Tesso Nilo area as a National Park, committed to protect high conservation value forests in its concessions, committed to legal log sourcing, committed to improvements in community relations, and initiated environmental reporting.

Improved regulation of the pulp and paper sector in Indonesia

Due to the reputational damage afforded the Indonesian paper industry, the Indonesian Government was compelled to take measures to mitigate reliance on natural forest for fibre. Thus, a Ministerial Decree on the 'acceleration of plantation development and pulp and paper industry raw material supply' was adopted, which requires specific improvement in fibre sourcing practices by 2009. This Decree has been subsequently interpreted in industry and government statements to require that each of Indonesia's pulp mills needs to source all of its wood from plantations by 2009. While the regulation does not take effect for another 2 years from the time that the analysis was conducted (2007), it is likely that accelerated plantation development has taken place in order to have sustainable supplies ready by this target.

Improved financial due diligence for forestry investments

This work may also have played a role in leading many investment institutions to undertake improved due diligence related to forestry investments. Financial analysts and banks affected by the publicity generated by CIFOR's findings concerning Indonesian pulp investments may have accorded greater attention to sustainable supply linkages for subsequent investments. Several international banks, such as JP Morgan Chase, Citigroup and Bank of America have subsequently adopted policies to ensure global forestry lending would support sustainable practices, and these commitments may have been influenced by CIFOR's findings. This may have resulted in less investment in pulp processing overcapacity in the rest of the world, as well as in Indonesia.

4 Chronology of events

This section contextualises the connections between CIFOR's research and the overall evolution of events related to the Indonesian pulp and paper sector, based on available documents and the results of key informant interviews. In so doing, it is a prelude to the attribution of CIFOR's specific contributions, which will be assessed in Section 5, so as to identify plausible assumptions for the development of counterfactual scenarios in Section 6.

4.1 APP and commitments to sustainability

As CIFOR's research results were released in late 2000, Asia Pulp and Paper (APP) was attempting to gain approval from the US Securities and Exchange Commission to extend the repayment period for $2 billion in bonds. After the release of CIFOR's findings, APP began to fail to meet its financial obligations. In January 2001, trading of APP shares on the New York Stock Exchange was suspended, while repayment of all $14 billion of accumulated debt was suspended in March. This suspension began a lengthy process of negotiations with Indonesian and foreign creditors.

Debt owed to insolvent Indonesian banks was absorbed by the Indonesian Bank Restructuring Agency (IBRA), a body formed to revitalise Indonesia's failing banking sector after the 1997 Asian Financial Crisis. Legal action was taken by a number of foreign creditors to force APP to meet debt obligations. However, Indonesian courts rejected the essence of these claims. As a result, creditors' only means for recovering debt was to enter a Master Restructuring Agreement, which IBRA took the lead in negotiating, along with nine export credit agencies (Setiono 2006).

In direct response to the *Profits on Paper* report, APP contracted a consulting firm, AMEC, to conduct an independent 'Sustainable Wood Supply

Assessment' in 2001, with the intention that such would refute claims that the company lacked a sustainable fibre supply. The 'background' section of the report (AMEC 2001) notes that:

> *Macro economic studies carried out by the Centre for International Forest Research (CIFOR) on the state of the Indonesian pulp and paper industry have produced data that suggest that the overall Indonesian industry cannot possibly ensure a sustainable supply of raw material for current production levels. Reports also allege that up to 40% of wood consumed in the industry to achieve its current output is from illegal sources, and that the pulp and paper industry in Indonesia has caused the deforestation of 835,000 ha over the last 12 years and the APP Indah Kiat Mill accounted for over one third of this.*
>
> *It has been inferred from these reports, that APP mill companies in Sumatra are obtaining a majority of their timber from undocumented and illegal sources, and as the largest operator it is causing much of the direct and indirect environmental damage in the sector in Indonesia. This inference has in turn led to loss of sales by APP companies in the international market.*
>
> *After reviewing the impact of the assertions in published reports, particularly on the capacity of SMG [Sinar Mas Group] forestry companies to develop sustainable plantation resources, APP commissioned an independent review of the 10-year wood supply plans.*

The report confirmed the severity of fibre supply risks confronted by the company, as a result of potentially conflicting claims over the company's concessions, as well as optimistic assumptions concerning plantation productivity. It also recommended that the company consider the 'international market acceptability' of clearing extensive areas of tropical forests for pulp, and undertake greater conservation commitments.

Friends of the Earth England, Wales and Northern Ireland (FoE-EWNI) initiated a campaign regarding the company in mid-2001, entitled: *Paper Tiger, Hidden Dragons: The responsibility of international financial institutions for Indonesian forest destruction, social conflict and the financial crisis of Asia Pulp & Paper*, which frequently cited CIFOR's report (Matthew and van Gelder 2001). This report was quickly reproduced in *The Guardian*, a prominent British newspaper.

Thereafter, WWF publicly called on APP to establish sustainable fibre sourcing practices. In addition, Friends of the Earth, WWF, Greenpeace and other NGO partners approached international buyers of pulp, and informed them of the environmental implications of APP's production practices. According to an FoE analysis of UK trade statistics (FoE-A 2002), FoE's campaign resulted in an

84% drop in Indonesian fibre exports and a 61% drop in paper sales to the UK, while APP paper imports to the EU fell by more than 50% (Matthew personal communication). WWF officials report that the Metro Group (Germany), Office Depot (USA) and Reco (Japan) were among major buyers that adopted procurement policies that ultimately caused them to cease purchases from APP (Foead personal communication).

A wide array of other NGOs – which had previously focussed on the human rights implications of logging concessions, the pollutants emitted from pulp facilities, or the more general prevalence of illegal logging – began to echo the very detailed critique first described in the Barr report. Within about a year of the initial release of *Profits on Paper*, Environmental Defense (USA), FERN (UK), Focus on Finance (The Netherlands), JIKALAHARI (Indonesia), Urgewald (Germany), Robin Wood (Germany), the Swedish Society for Nature Conservation (Sweden), WALHI (Indonesia) and the World Rainforest Movement (Uruguay) had all initiated campaigns that echoed Barr's arguments. New networks of these NGOs formed around pulp and paper issues in the next few years, such as the Community Alliance on Pulp and Paper Advocacy (Indonesian NGOs), Eyes on the Forest (including WWF, WALHI and Jikalahari), as well as virtual communities, including Pulpmillwatch, APPwatch and APRILwatch.

Meanwhile, WWF also privately approached creditors who were engaged in a dialogue regarding the restructuring of APP's debt obligations (which it had defaulted on). In particular, WWF entered confidential negotiations with the Export Credit Agencies, which were leading the restructuring negotiations. As a result of the latter, an explicit commitment to environmentally sustainable fibre sourcing was included in an appendix to the 'Master Restructuring Agreement' (MRA), which went into effect in 2003.[6]

Subsequently, WWF directly engaged APP in negotiations. In 2003, this resulted in a 'letter of intent' signed between the two entities, which was premised on a commitment to assessment and protection of high conservation value forests (HCVFs), as well as establishment of a 'sustainability action plan' by which APP would quickly develop a plantation-based fibre supply (WWF Indonesia 2003). The owner and Chair of APP and the Sinar Mas Group, Teguh Ganda Wijaya personally signed the letter (Foead personal communication).

On the basis of background studies conducted by the consulting firm AMEC, APP produced a 12 year 'sustainability action plan' in 2004 and invited public comments (APP 2004). WWF hired two external reviewers to appraise the plausibility of the plan, which was found to contain a number of unrealistic assumptions. In February 2004, WWF withdrew from the 'letter of intent' agreement because APP's plan had not adequately addressed the issues of protection of forests with high conservation value, use of third party mediators in social conflicts and long-term sustainability (WWF Indonesia 2004). APP

[6] Unfortunately, it has not been possible to obtain the text of the MRA, as it is not a public document.

proceeded to release the plan in late 2004 without substantive adjustments (Foead personal communication). Since that time, reported annual first rotation plantation establishment rates have rapidly and continuously risen from 49 000 hectares planted in 2001 to a projected 230 000 hectares to be planted in 2007 (APP 2006).

After WWF's withdrawal, APP contracted the SmartWood programme of the Rainforest Alliance in May 2004 to conduct assessments of HCVFs in four concession areas managed by Sinar Mas: Kecil Siak, Serapung, Pulau Muda and Giam Siak. Once HCVF areas were identified, SmartWood was to monitor the condition of the 120 000 hectares of forest to be conserved in the concessions. To do so, the programme was intended to include analysis of satellite images and aerial photographs, as well as ground surveys to verify protection of the set-asides.

Most of the area of the four concessions was subsequently set aside from logging by Sinar Mas. However, during audits of the HCVF conservation, SmartWood found that the company did not take proactive measures to conserve and manage the set-asides (Rainforest Alliance 2007). Protection from illegal loggers was found to be insufficient, boundaries in the forest were not fully demarcated, and there was moderate (10%) loss of forest area. Three major Corrective Action Requests were issued in 2006. In early 2007, SmartWood determined that these had not been fully met within the required timeframe, and terminated its engagement with the company.

Nevertheless, as of 2006, some 107 000 hectares of HCVF reportedly remain preserved in Sinar Mas concessions in the HCVF delineated areas (Munoz personal communication; APP 2006; WWF Indonesia 2006). While some of the areas may not have been profitable to harvest, it is likely that, in the absence of these commitments, large portions of these areas would have been cleared (Munoz personal communication).

The company released its first 'Sustainability Report' in 2006, which reports on previous environmental commitments, and reveals new conservation programmes (APP 2006). In particular, the company is seeking to designate its Bukit Batu and Giam Siak Kecil HCVF set-aside as a UNESCO Man in the Biosphere Reserve. The company has also contributed approximately 15 000 hectares of set-aside to the Senepis Buluhala Tiger Sanctuary, and is defining conservation set-asides to assist orang-utan conservation in the Kutai National Park in East Kalimantan. The company is also pursuing certification from the Indonesian Ecolabeling Institute (LEI) for 200 000 hectares of concession by 2008.

4.2 APRIL and commitments to sustainability

In 2001, after the release of CIFOR's *Profits on Paper* report, WWF began a campaign to call upon APRIL to halt logging in the Tesso Nilo area, so as to protect Sumatran elephant populations in the vicinity. Subsequently, WWF

targeted buyers of APRIL paper in prestige foreign markets, including the UK, Japan and Germany. According to one of WWF's principal campaigners involved in the advocacy, buyers were receptive to WWF's messages, in part because of the very visible prior advocacy concerning the practices of APP (Foead personal communication).

To broaden the remit of its message, WWF contacted CNN, which ran a story in February 2002, describing the 'record biodiversity' in Tesso Nilo, which was threatened with destruction by logging companies in the area (Easen 2002). Simultaneously, FoE-EWNI released an attention-attracting report entitled *Paper Tiger, Hidden Dragons 2: APRIL fools: The forest destruction, social conflict and financial crisis of Asia Pacific Resources International Holdings Ltd (APRIL), and the role of financial institutions and paper merchants* (Matthew and van Gelder 2002), based largely on the findings of *Profits on Paper*.

In March 2002, APRIL announced that it would halt its logging operations in the Tesso Nilo area, and began to support conservation efforts that ultimately led to establishment of a 38 000 hectare National Park in the area in 2004. Active cooperation between WWF and APRIL began with an agreement on halting illegal logging in late 2002. SGS (a consulting firm) and WWF thereafter began to cooperate on tracking of the origin of APRIL's fibre supplies (APRIL 2003).

After extensive negotiation, in 2005 WWF and APRIL agreed in principle on a 'responsible forestry' strategy by which APRIL commits to (1) fully transparent operations that do not consume wood from HCVFs, and (2) to support the expansion and protection of Tesso Nilo National Park (WWF Indonesia 2006). In practice, the former has meant that APRIL has committed to use the HCVF toolkit for Indonesia to identify HCVFs for protection and management in all concessions developed after January 2005 that are under APRIL's direct management. Thus, concessions developed prior to 2005 are excluded from the requirement, as are community fibre farms. As of late 2007, seventeen APRIL forest management units have been subject to HCVF assessment, of which one was conducted externally, and most are reviewed by a consulting firm (Proforest) or WWF, or both (Franklin personal communication).

The effects of HCVF assessment are somewhat difficult to discern. Based on conservation set-aside data from APRIL and areas identified for HCVF assessment by WWF, it appears that the 16 forest management units that could be identified as subject to HCVF assessment have only marginally higher proportions of area set aside than do areas that have not been subject to such (29.8% versus 27.7% of total area) (analysis of data from APRIL 2007). More detailed effects of HCVF assessment on the quality and management of conservation set-asides are not possible to discern from available data.

However, the reported proportion of APRIL's and its joint ventures' total concession area devoted to conservation has risen during recent years. According to the company, the average proportion of concession area devoted to conservation before the release of *Profits on Paper* was less than 17%.

It reportedly stood at over 28% in 2007 (APRIL 2007). While the proportion of conservation set-aside was already rising prior to the CIFOR research and associated civil society campaigns, there has been an increase in the rate of relative growth of conservation areas. From 1993 to 2001, the proportion of conservation set-aside rose from 14.0% to 19.7% of concession area (0.7% per year), whereas from 2001 to 2007 the proportion of conservation area rose from 19.7% to 28.2% (1.4% per year) (APRIL 2007).

APRIL has also reportedly made greater efforts to reduce carbon emissions from peat areas through improved water table management. Once canals are established in peat areas, peat begins to drain and dry, and the water table falls. As the peat dries, the very extensive carbon reserves in the soil oxidise and are released. In 2003 and 2004, the company began efforts to improve the monitoring and management of water table depth. In 2005, the company agreed on a science-based management support project with Delft Hydraulics and Proforest, which is intended to model peat hydrology in the concessions, and to initiate interventions to prevent drainage. As a result, control dams with manually maintained bypass channels to control water flows in small increments were designed, and have been installed in hundreds of locations. The company began to raise water levels in 2006, and has plans to raise levels by another 30–40 centimetres by 2008, with reduced fluctuation in the Kampar peninsula (Bathgate 2007).

The company has also made changes to its stated policies regarding engagement with local communities. According to company officials, APRIL is committed to applying the principles of 'Free, Prior and Informed Consent' to the resolution of land disputes with local communities, although detailed conflict resolution procedures were still being developed in 2007 (Franklin personal communication). In 2006, the company also became signatory to the United Nations' Compact, which commits it to 10 areas of social responsibility, including human rights. In early 2006, APRIL gained LEI Certification for 159 500 hectares of concession area (APRIL 2006).

4.3 Reforms towards a sustainable fibre supply by the Ministry of Forestry

4.3.1 The Consultative Group on Indonesia and the Indonesian Bank Restructuring Agency

After the onset of the 1997 Asian Financial Crisis, the Suharto regime approached the International Monetary Fund (IMF) for assistance, and the IMF responded with a US$ 43 billion loan 'bailout' package. Although the initial 'letter of intent' for the package included no specific attention to forestry issues, the second letter of intent related to this assistance (early 1998) specified a number of reforms related to the forestry sector, including a shift towards higher timber royalties, steps to eliminate monopolies, reform of the concession system and stipulation that the reforestation fund (which had previously primarily funded activities unrelated to forest establishment;

Sunderlin 1998) be moved to the central budget and be used only for reforestation activities (Barr 2001). After Suharto's resignation a few months later, actual substantive implementation of reforms began to stall, with the exception of steps to eliminate monopolies and the reform of the reforestation fund. Forestry sector reforms were subsequently prominent aspects of two World Bank Policy Reform Support Loans, but progress remained slow.

In July 1999, the Consultative Group on Indonesia (CGI), a group of bilateral and multilateral donor agencies concerned with the IMF bailout loan agreement and associated support measures, began to address forestry issues. Given the large amount of forestry sector debt that was among the portfolios of failed financial institutions after the crisis, the CGI subsequently became an important forum for donors to discuss possible solutions to the many problems affecting the forestry sector. A high level post-CGI seminar was convened in February 2000, which allowed unprecedented discussion of problems facing the sector (Barr 2001). As a result of this meeting, a Donor Forum on Forests (DFF) was established to express coordinated recommendations for forestry sector reforms.

The seminar also appeared to lead to renewed commitment to forestry reform, as shortly thereafter the Government of Indonesia agreed to eight forestry sector reforms, of which four are of direct relevance to the pulp industry (Barr 2001):

1. a moratorium on all conversion of natural forests until agreement on a National Forest Programme is reached;
2. restructuring of wood processing industries to balance timber supply and demand;
3. closure of heavily-indebted forestry companies under the control of the Indonesian Bank Restructuring Agency (IBRA);
4. an increase in timber royalties to reflect their full market value.

The Indonesian Government followed up on these recommendations with the establishment of an Inter-Departmental Committee on Forests, which was to increase coordination between the Ministry of Forestry and the Ministry of Trade and Industry (Setiono 2006). In addition, a Ministerial Decree passed in 2000 imposed a moratorium on forest conversion for nonforest development. This was accompanied by reforms to the wood utilisation permit system stipulated by Ministerial Decree 10.1/2000, which states that plantations should only be established in bare areas with less than 5 cubic metres per hectare of natural trees with a diameter over 10 centimetres. In practice, neither measure was fully implemented, and forest conversion continued. Moreover, implementation of other reforms stalled soon after.

The Indonesian Bank Restructuring Agency (IBRA), an entity formed to revitalise and restructure the Indonesian banking sector, ultimately ended up absorbing about US$ 1 billion of debt from APP after its 2001 default, and $400 million from APRIL after the 1997 financial crisis (Setiono 2006). Although IBRA was vested

with broad authority to alter management practices, alter debt agreements, and restructure industries, the group did not exercise such authority.

In APRIL's case, IBRA and other creditors agreed to waive interest payments for 18 months to finance the expansion of its largest mill's annual processing capacity from 750 000 to 1.3 million tonnes of pulp in 1999, with the stated rationale that the company could repay its debts more quickly if expanded (Setiono 2006). CIFOR's initial research was released after this decision, but before decisions were taken regarding IBRA-held APP debt.

At the time that the *Profits on Paper* study was being finalised (early 2000), CIFOR, DFID, academics and civil society groups formed an Indonesian Working Group on Forest Finance (IWGFF) to influence the Donor Forum on Forests. The first meetings of the IWGFF were devoted principally to discussion of the *Profits on Paper* findings, and how they could be utilised. In turn, the Donor Forum on Forests adopted policy positions similar to those recommended by CIFOR's research. For example, in 2003, the Forum released a Working Group Statement on Forestry for consideration at the CGI meeting, which echoed CIFOR's recommendations for closure of highly indebted wood industries that lacked adequate raw material supplies (DFF 2003):

> *Unfortunately, IBRA has ignored multiple requests from the Department of Forestry to allow it to evaluate the raw material supplies of the mills before their debts are sold. Instead, the sales are moving ahead. This places pressure on the nation's forests, and creates a climate of moral hazard.*

Although CIFOR's research may have helped to influence this policy position, this pathway ultimately had little influence. IBRA did not intervene in APP's operations, left leadership to the Widjaja family, and promoted a Master Restructuring Agreement that heavily favoured the interests of the company over its creditors. Moreover, IBRA divested its debt in APP through a 'fire sale' in 2003, which result in $880 million of debt being sold to a US investment entity for $213 million, with little participation from the Ministry of Forestry (Setiono 2006).

4.3.2 Development of Ministerial Decrees on acceleration of plantation development

At the same time, officials in the Ministry of Forestry were aware of the growing reputational problems of the Indonesian forestry sector. The pulp and paper sector, which was the wood processing industry previously perceived to have the greatest future potential, was losing access to export markets, partially as a result of WWF and FoE campaigns about the environmental and social sustainability of fibre sourcing practices spurred by CIFOR's research. It was clear that action needed to be taken to move the industry towards a sustainable plantation-based raw material supply, as a result of export market demands, but with a 'soft landing' (MoF 2003).

In 2002, the Ministry of Forestry established a Task Force under the Directorate General of Forest Production to 'enhance plantation forest development'. What emerged from this Task Force was a plan to give the pulp and paper industry sufficient time to develop plantation-based fibre supplies, and subsequently limit fibre harvesting from natural forests (MoF 2002).

In mid-2003, the Indonesian Ministry of Forestry issued the Ministerial Decree number 162/2003 (*Surat Keputusan Menteri Kehuatan Nomor* 162/Kpts-II/2003) on 'acceleration of plantation development and pulp and paper industry raw material supply', which requires that plantation areas of the pulp-affiliated concessions be fully developed by 2009. The Decree specifically mentions six companies, of which two are affiliated with APRIL, two are affiliated with APP, one has a relatively small pulp capacity (Kiani Kertas with 0.5 million tonnes per year), and one has subsequently closed (Kertas Kraft Aceh). The Decree also stipulates that a microdelineation process should be applied to identify areas of natural forest with high conservation value, or that are on other areas for which conversion is prohibited (such as sloped areas, deep peat soils and riparian zones).

The Decree was 'restipulated' in 2004 in a second Ministerial Decree (SK.101/Menhut-II/2004), and expanded to include the entire pulp and paper industry, without other apparent substantive changes. In 2005, the Decree was 'amended' under Ministerial Decree SK.23/Menhut-II/2005 to include all of 'the primary timber forest product industry'. This series of Decrees has been subsequently interpreted in government and industry statements to require that each of Indonesia's pulp mills needs to source all of its fibre from plantations after 2009, based on the fact that plantation expansion should cease at that point (Anonymous 2006).

Since the time of the Decree, planting rates have risen markedly in the concession areas of APP and APRIL. While, prior to the Decree, the annual rate of new plantation establishment was increasing at a moderate rate of 4.7%, since the Decree, annual first rotation planting rates have risen by 20% per year. It is likely that the Decree has contributed to some of this accelerated plantation development in order to have sustainable supplies ready by the 2009 target (Munoz personal communication). Thus, the Decree may have helped to avert dependence on natural forests for fibre supplies after this date.

4.4 Averted additional expansion of pulp processing overcapacity in Indonesia

From 1990 to 2001, pulp processing capacity in Indonesia rose by more than 40% annually, from 1.0 to 5.9 million tonnes (Barr 2001). However, although various plans for potential capacity expansion have been circulated at various times, since the release of CIFOR's initial research, there has been no major expansion of pulp processing capacity in the country (as of October 2007). This analysis investigates the degree to which this is attributable to CIFOR's research and the advocacy that built upon it.

In 2003, United Fibre Systems (UFS) began to attempt to secure financing for a 600 000 tonne greenfield pulp mill in South Kalimantan (Jurgens *et al.* 2005). The project was originally conceived in 1994 by PT Menara Hutan Buana and PT Marga Buana Bumi Mulia, owned by former President Suharto's half-brother Probosutedjo, but was put on hold when the Economic Crisis hit in 1997. Those companies were eventually sold to a group of holding companies incorporated in the British Virgin Islands, and were merged under the UFS name. UFS reportedly secured an agreement with the China National Machinery and Equipment Import and Export Corporation (CMEC) for 80% of the construction costs for the mill. The company also secured provisional financing from a consortium of international investors, which was contingent upon the approval of political risk insurance from the World Bank's Multilateral Investment Guarantee Agency (MIGA).

By the time that details of this proposal became public, a wide range of NGOs was attuned to developments in the Indonesian pulp sector. A consortium of 65 NGOs from 19 countries protested the application by letter to MIGA in 2004 (Lang 2007). CIFOR also became involved in providing information and suggestions to the World Bank office in Jakarta regarding the viability of the mill's wood supply plan, as well as to US Treasury officials who advise members of the Bank's Board of Directors. Many of those involved in discussions in Indonesia over the proposed mill were the same actors who took part in discussions at the CGI, which urged IBRA to reduce pulp sector processing overcapacity.

In January 2004, after the vociferous NGO campaign, UFS withdrew its application for political risk insurance from MIGA (Jurgens *et al.* 2005). Although MIGA did not explicitly reject the application, it is likely that withdrawal was requested by the Agency to avoid the public embarrassment of an overt rejection. Since the time of the withdrawal, the pulp mill has not been built, although a 700 000 bone dry metric tonne wood chip plant was built with a combination of finance from CMEC and the Raiffeisen Zentralbank Osterreich in 2004.

While the deterrence of investment in the pulp processing sector may not be immediately apparent as a beneficial outcome, in the Indonesian context of fibre supply deficits and pulp processing overcapacity, it does help to prevent additional subsidised clearing of natural forests. Indeed, in this case, although UFS stated that the mill would be plantation fed, it declared that 25% more standing timber was available than an independent consulting firm (Jaakko Povry) measured, and it may have further exaggerated planted area by over 80%. Thus, the mill would have been likely to be reliant on natural forest sourced fibre, in a similar manner to APP and APRIL.[7]

[7] It could be contended that the aversion of mill expansion in Indonesia has led to mill expansion elsewhere, with accordant displacement of deleterious consequences. However, no documented case of natural forest clearing for pulp production elsewhere in the tropics matches the magnitude of the trend observed in Indonesia. In the specific instance discussed here, there is no evidence to suggest that the specific investors involved have diverted averted investment into pulp mills elsewhere.

5 Attribution of CIFOR's contributions

5.1 WWF

Key informants from WWF Indonesia (Nazir Foead, Species Program Director) and WWF US (Bruce Cabarle, Director of Global Forest Programs) credit CIFOR's research with substantial contributions to their advocacy campaigns, and support the notion that the research was essential to obtain environmental commitments during the negotiation of debt agreements for APRIL and APP. A third key informant, Michel Steuwe (currently an independent consultant), stated that the *Profits on Paper* study played a direct role in advocacy regarding APP, but that its influence on the APRIL campaign was more indirect, and principally arose through contributions to the APP campaigns, which drew attention to the sector and created a receptive climate for advocacy regarding APRIL.

While informants from WWF stated prior awareness of unsustainable fibre sourcing policies by the companies, they lacked specific figures, and were not aware of causes of investment in pulp sector overcapacity. In the absence of the data that CIFOR's research provided, rebuttal of company claims and counterarguments would have been difficult. Given WWF's capacity at the time, all three stated that there would have been a significant lag before similar information could have been generated. Moreover, two of the informants asserted that an alternative research agency would not have leant the topic an equivalent level of credibility. As a result, the campaigns would have been slower in generating influence.

Although engaged in Riau since 1999, WWF had not engaged in substantive advocacy over the Indonesian pulp and paper industry prior to the release of the *Profits on Paper* report in late 2000. According to the three informants, WWF became engaged in advocacy over APP once Friends of the Earth initiated their campaign regarding the company in mid-2001.

Thereafter, WWF publicly called on APP to establish sustainable fibre sourcing practices. According to Mr Foead and Dr Steuwe, WWF and NGO partners subsequently approached international buyers of pulp, and informed them of the environmental implications of APP's production practices. In addition, WWF directly approached creditors engaged in negotiations regarding the restructuring of APP's debt obligations (after its debt repayment suspension). These focused on the Export Credit Agencies, which were leading much of the restructuring negotiations, and involved confidential negotiations. As a result, according to Mr Foead and Dr Steuwe, an explicit commitment to environmentally sustainable fibre sourcing was included in an appendix to the 'Master Restructuring Agreement', which went into effect in 2003.

WWF officials report that their engagement with APRIL has been essential in obtaining a number of environmental commitments from the company. They believe that WWF's advocacy over Tesso Nilo led to APRIL's commitment to support the establishment of a National Park, and led the company to lobby other forestry operations in the region to help add to the conserved area. Following successful collaboration over this issue, WWF was able to engage APRIL on legal timber supply commitments with a 'little MOU [Memorandum of Understanding]' in 2002, according to Dr Steuwe. Eventually, after extensive negotiations, WWF was able to convince APRIL to adopt the HCVF policy through an 'in principle' agreement, according to the informants.

More generally, Bruce Cabarle noted that the research helped WWF to understand the economic drivers of deforestation, and set a 'precedent' for analysing the business model of investments with negative environmental externalities, so as to identify potential associated financial risks. This has become an integral element of WWF's new conservation strategy, and has helped the organisation to focus on the potentially flawed assumptions underpinning oil palm and soya bean expansion into forested areas in Indonesia and Brazil.

5.2 Friends of the Earth

Friends of the Earth England, Wales and Northern Ireland (FoE-EWNI)

The principal campaigner involved with Friends of the Earth advocacy regarding the Indonesian pulp and paper sector (Ed Matthew) explained that there were three contextual factors that drove the decision to initiate campaigns against APP and APRIL. At the time, UK domestic paper manufacturers were concerned that illegal and unsustainable practices among developing country competitors were undercutting sustainable production. Concurrently, FoE saw increased demand for corporate social responsibility. Meanwhile, WALHI (the Indonesian arm of Friends of the Earth) was seeking opportunities for visibility and leverage against the pulp and paper companies responsible for deforestation.

According to Mr Matthew, however, while there was a general recognition of wood processing overcapacity, at the time there were no reliable or precise

data regarding the practices of specific companies. CIFOR's *Profits on Paper* report changed this situation by offering credible data to make a convincing case that the company's practices were unsustainable and created reputational risk.

Moreover, the information provided in the report was the impetus to identify companies that had invested in APP, so that campaigns could be launched to influence financial institutions with substantial exposure. A report entitled *Paper Tiger, Hidden Dragons: The responsibility of international financial institutions for Indonesian forest destruction, social conflict and the financial crisis of Asia Pulp & Paper* was released in May 2001 on the stated basis of CIFOR's findings. Subsequent advocacy was directed at the financial institutions involved, through shareholder meetings and other events.

Mr Matthew reports that FoE-EWNI used the CIFOR findings and its own followon research to pressure European buyers of APP and APRIL pulp and paper. According to the FoE campaigner, nearly every buyer that was directly approached cancelled its purchases with the company. By the campaigner's estimate, APP's pulp exports to the UK fell by 95%, while those to Europe fell by 50% as a result. APRIL experienced similar sales declines.

Although exports to Europe were a relatively small share of sales, he believes the effect on 'prestige markets' was important in creating pressure for improvements. While FoE's direct engagement with the two companies was rather limited, WWF was reported to utilise the pressure to negotiate for commitments to improvements in sustainability.

FoE-EWNI campaign regarding APP and APRIL was only a substantive focus for one year, although limited engagement continues. However, the former manager of the campaign notes that the conduct of subsequent advocacy has been influenced by this experience. He suggested that FoE took notice of the value of research and reliable data for the ability to persuade investors and customers about the negative effects of the companies with which they do business. As a result, FoE has increasingly engaged with the academic community to bring credible scientific evidence into the campaigns that it conducts, and has even begun to fund, at times, research by academic bodies.

Friends of the Earth Finland

FoE Finland had a history of campaigning regarding the Indonesian pulp and paper sector that traced back to 1997, and which focused on UPM-Kymmene's (a Finnish paper firm) 'alliance' with APRIL. In 1998, when APRIL was nearly bankrupt, UPM-Kymmene scaled back its involvement with APRIL, and began a dialogue with Finnish NGOs. In 1999, FoE Finland released a book entitled *The Calculated Risk – UPM-Kymmene in Indonesian rainforests* (Miettinen and Selin 1999), which qualitatively described the social and environmental risks of APRIL's practices.

However, according to Otto Miettinen, FoE Finland's primary campaigner regarding these issues, the FoE campaign lacked reliable figures and data to show the exact extent of the effects qualitatively claimed. CIFOR's findings were 'essential' to establishing rigorous data for campaigning, and helped to provide a model for presenting arguments. In the absence of CIFOR's research, the campaigns would likely have been smaller, and there would have been a reduced ability to counter the pulp companies' claims. FoE and other NGOs did not have the capacity to generate the information contained in the CIFOR report, so a substitute would not have been readily available.

According to Mr Meittinen, this helped to enable FoE Finland to avert additional involvement and investment by Finnish companies in Indonesian forest conversion. It also facilitated FoE Finland's ability to put pressure on UPM-Kymmene to demand environmental improvements from APRIL, as a creditor to the company and buyer of its pulp.

Friends of the Earth Indonesia / WALHI

WALHI (the Indonesian Environmental Forum, also known as Friends of the Earth Indonesia) had a long history of campaigning on forestry issues prior to CIFOR's research. In 1988, the NGO filed and won a landmark lawsuit against PT Indorayon Utama (a company owned by Raja Garuda Mas, the parent company of APRIL) regarding environmental discharges in Porsea, North Sumatra. Subsequent campaigns by the NGO focussed on effluents from other pulp projects (such as the PT Tanjung Enim Lestari mill), land disputes between pulp concessionaires and local communities, and the general unsustainability of pulp operations. Just before the CGI meeting in early 2000, WALHI launched a campaign for a general moratorium on industrial logging in Indonesia.

Three key informants were interviewed from WALHI to identify the degree to which its campaigns drew on CIFOR's findings, and whether substitute information would have been available. Longena Ginting, the former Executive Director of WALHI, described how the organisation had campaigned for 15 years regarding pulp sourcing practices, but had limited results, due to a lack of credible data regarding the exact details of company actions. He noted that the findings from CIFOR, as a relatively neutral international research centre, provided the necessary credibility to convince a wide array of audiences of the risks posed by APP's and APRIL's practices, and provided the ammunition for developing international campaigns. The international campaigns provided 'leverage' for generating specific commitments by the companies.

Mr Ginting reported that WALHI initiated a campaign focussed on APP and APRIL in 2001, which focussed on the companies' possible use of illegally sourced pulpwood. Interviewed informants report that the organisation worked with Greenpeace to target Japanese buyers, with the result that Xerox cancelled purchases from APRIL. WALHI worked with Friends of the Earth International and Robin Wood to get Papir Union (a large German buyer)

to withdraw from its contracts with the companies. In cooperation with the Rainforest Action Network, WALHI helped to convince Home Depot, an American building supply firm, to cancel purchases from APP.

Patrick Anderson began to work as a forests campaign advisor to WALHI in 2001, and helped the NGO to link its campaigns with those of international NGOs, so as to use access to export markets for leverage. He also affirms that the international campaigns based their findings largely on CIFOR's work, prior to which arguments centred around 'elephants and tigers'. The 'solid information' from CIFOR expanded the range of organisations involved, and enabled NGO dialogue with APP and APRIL. Given that the principal NGOs campaigning, WWF and FoE, had limited capacity to analyse finance issues and had few data regarding the companies' resource base, no substitute for this information would have been easily available.

Mr Anderson reported that, partially as a result of additional international attention, sufficient leverage was developed to avert approval of MIGA political risk guarantees for the proposed UFS Mill in South Kalimantan. Partially as a result of WALHI's cooperation with international partners, Deutsche Bank withdrew from the project. In addition, as a result of the observed usefulness of international exposure, the 'Eyes on the Forest' project was established as a collaboration among WALHI, WWF and Jikalahari.

Rully Syumanda, a forests campaigner for WALHI, also became involved in campaigns regarding APP and APRIL in 2001. Much of his work has focussed on illegal logging by the companies. According to him, CIFOR's data provided a starting point for analysing illegal log flows to the companies, as the *Profits on Paper* report identified a large proportion of fibre supplies with untraceable origin. Mr Suymanda claims that the Eyes on the Forest initiative has fed data to the Riau police, which are being used in an ongoing (as of late 2007) investigation of APP and APRIL for violating Ministry of Forestry regulations. In the absence of CIFOR's research, his advocacy regarding the companies would have been delayed, as WALHI did not have the expertise to analyse wood supply issues.

5.3 Indonesian Ministry of Forestry

Two informants were interviewed regarding the development of the Ministerial Decree on acceleration of plantation development for the pulp and paper sector. Mr Wahjudi Wardojo, the former Secretary General of the Ministry of Forestry (and the present Director General of the Forestry Research and Development Agency), and Dr Togu Manurung, Advisor to the Minister of Forestry, were questioned about the Decree's development and plans for enforcement.

Mr Wardojo explained that the Ministry reviewed the development of Industrial Forest Plantations, and found that progress was very slow, particularly for the pulp and paper sector. This was due in part to deficiencies in the way in which the Ministry of Industry and Trade gave approval for the development of wood

processing industries, and did so without coordination with the Ministry of Forestry, which regulated raw material supplies. Thus, to correct the shortage in plantation-based raw materials, a target for plantation development needed to be set, which would allow the industry sufficient time for trees to mature before natural forest conversion would need to stop. Thus, 6 years, the length of one rotation, was provided for plantation development.

Mr Wardojo also explained that forest conservation had not previously been a priority for the Ministry of Forestry. Due to greater environmental awareness, conservation has risen in profile within the Ministry, as evidenced by the fact that he moved from the position of Director General of Conservation to Secretary General, which is the second highest Ministerial position. Such a path of accession was unprecedented, as the Conservation Department had low relative prestige prior to 2001. Subsequently, reorganisation occurred to mainstream conservation into the work of other Departments within the Ministry. As a result, perceptions have evolved such that natural forests are considered to be a resource to be conserved, rather than one to be exploited. This was part of the impetus for the Decree, and its microdelineation requirements, which are intended to protect high conservation value portions of the forest concessions.

According to Mr Wardojo, the *Profits on Paper* report was one of several influences that drew attention to the need to develop plantation-based fibre supplies for the pulp industry, but that growth in general attention to conservation issues was important as well. One important driver of increased attention to conservation included increased environmental standards of international pulp buyers, as Indonesia was losing access to international export markets, due to concerns about the sustainability of pulp production.

The effects of the Decree include increased planting rates, according to Mr Wardojo, but he also acknowledges that there is uncertainty about the degree to which the companies will be penalised for non-compliance. He notes that the present police investigation in Riau has delayed plantation development, which may affect the ability of companies to meet the deadline.

At the time of the Decree's issuance, Dr Manurung was working with Forest Watch Indonesia. However, from his involvement then as an advocate, and presently as a Ministerial Advisor, he feels that the Decree was largely a response to NGO pressure, so as to rehabilitate the international image of the Indonesian pulp and paper sector. He feels that the decree has had some success in prompting the industry to develop plantations more quickly. In addition, microdelineation has to some degree slowed the ability of the pulp companies to clear natural forested areas.

5.4 Asia Pulp and Paper (APP)

Sinar Mas Forestry's (APP's exclusive fibre supplier) Director for Environment (Canecio Munoz) described improvements that the company has made to the sustainability of fibre sourcing operations. The company has greatly increased planting rates, such that 300 000 hectares of total planting is targeted for 2007, of which 236 000 hectares has been reported as realised by the end of the year.[8] Much of the planting, particularly in East Kalimantan and South Sumatra is in areas of *Imperata* grassland. Planting has become the primary performance incentive within the company, so as to meet the end of 2009 target for a plantation-based fibre supply.

The company is seeking to develop better ability to identify conservation set-asides through a 'conservation value' identification toolkit for forests. This internally developed tool will not be the same as the existing HCVF toolkit for Indonesia, but will be an approach developed by the company as an enhancement of microdelineation requirements introduced by the Ministerial Decree on acceleration of plantation development.

According to Mr Munoz, the company is attempting to improve the effectiveness of some of its conservation set-asides through collaboration with other organisations. In particular, the company is seeking to develop the Bukit Batu and Giam Siak Kecil HCVF conservation set-asides as part of the UNESCO Man and the Biosphere Reserve programme; it is developing the Taman Raja in Jambi as a conservation area; it is cooperating with orang-utan conservation efforts in the Kutai National Park; and it is collaborating on the Senepis Buluhala Tiger Sanctuary. The company has a policy of wood legality verification system and procedure, so as to prove and ensure that no illegally sourced timber enters the mills. It is also actively seeking to obtain LEI certification for a number of concession areas, and has started to address deficiencies identified in 2006 in order to do so.

According to Mr Munoz, the influence of CIFOR and NGO advocacy that built on its research was important to initial environmental commitments by the company, including HCVF assessment in the four concessions where the approach was 'piloted'. He notes that 92% of the set aside forests remain, even though the company did not apply the approach to additional areas. In addition, advocacy may have helped to accelerate other improvements, although the influence is more indirect.

Mr Munoz noted that the Ministerial Decree on acceleration of plantation development has been very influential for the company, as the company has experienced a 'very big push' to accelerate planting rates, so as to have a plantation-based fibre supply ready by the target. According to him, the assumption within APP is that the target will be enforced. In addition, the microdelineation requirements of the Decree have caused conservation set-aside rates to rise from 10% to over 20%.

[8] The 236 000 hectare figure was provided in an email commentary on this section by Mr Munoz in July 2008. Thus, it is actually a more recent figure than was reported during the interview.

5.5 Asia Pacific Resources International Holdings Limited (APRIL)

APRIL's Director of Environmental Sustainability (Neil Franklin) and Civil Society Engagement Consultant (Johnathon Wootliff) stated that APRIL has increased commitment to environmental sustainability substantially as a result of NGO campaigns that built on CIFOR's research. Although APRIL had social engagement programmes from the late 1990s, its environmental commitments did not extend beyond basic legal compliance with conservation set-aside requirements of 15% of concession area. Moreover, according to Mr Wootliff, the company was secretive, and in some cases was less than honest about its operations.

According to Mr Wootliff and Dr Franklin, the *Profits on Paper* report and the 'APRIL Fools' campaign by FoE-EWNI were 'a perfect storm' that highlighted the need to make improvements to sustainability. Mr Wootliff described the Barr report as 'an iconic event that did more to galvanise improvements than any other'. The two informants credit CIFOR with prompting nearly every improvement in social and environmental sustainability made since the release of the report. They also state that CIFOR is part of the 'balanced scorecard' performance appraisal system of the company regarding environmental metrics.

Mr Wootliff described the motivation for improvements as twofold. First, that the management has 'pride' in running good operations, and has a desire to operate in a socially respectable manner. Second, the company wants to maintain and expand access to Western prestige export markets, and is willing to invest in environmental sustainability in order to do so.

Concrete improvements mentioned by the officials in response to NGO pressure include a commitment to independently assess and conserve high conservation value forests in all concessions developed after 2005, a commitment to use principles of 'Free, Prior and Informed Consent' (FPIC) to resolve conflicting land claims, and greater transparency about operations.

HCVF assessment is being performed using the six categories of values of the HCVF toolkit, three of which relate to environmental values and three of which relate to social values. The assessment is internally conducted in most cases, but is subject to external peer review. For controversial concessions, the entire process is contracted out. Such assessment results in mapping of different land uses, and associated management plans. The informants confirmed that commitments to set-asides are for perpetuity. The company is also participating in the revision of the HCVF toolkit for Indonesia in two concessions.

The two informants suggested that the commitment to the principles of FPIC is intended, but that specific procedures are still being implemented, as there is not presently sufficient institutional capacity in Indonesia to fairly ascertain community consent. In November 2007,[9] APRIL intends to participate in a

[9] That is, after the study had been completed—no more up-to-date information available.

workshop convened by the Forest People's Programme to define how FPIC could actually be practised.

In general, the company officials claim that the company is now much more willing to engage with civil society groups. Previously, NGOs were perceived as 'extortionists'. Now, corporate officials realise that many NGOs are important 'watchdogs' which help to improve operations, and which help to fill the vacuum left by limited governance capacity. The informants point to the company's 'open door' policy and collaboration with a number of NGOs as evidence of this shift.

The APRIL representatives interviewed claim that the company has essentially embedded sustainability into much of its strategy. As an example, they point to the appointment of Rudi Fajar, the former Director of Sustainability, as the company's president. They also suggest that the company's membership of the World Business Council on Sustainable Development verifies this shift.

It should be noted that the company officials interviewed do not accept that there is a need to shift to an entirely plantation-based fibre supply. They claim that HCVF assessment serves as an adequate safeguard measure, with which conversion of lower conservation value forests should be considered permissible. Thus, the company does not feel that conversion of mixed tropical hardwoods will need to cease after 2009, as is stipulated by the Ministerial Decree on acceleration of plantation development. However, the informants do claim that the increased 'microdelineation' requirements of the Decree have slowed the expansion of concession area available for forest clearance.

5.6 Officials dealing with potential investments in new pulp capacity

US Treasury

The senior Environmental Specialist for International Affairs at the US Treasury (Keith Kozloff) confirmed that he utilised reports and direct communication from CIFOR Scientist Chris Barr to develop a series of questions submitted to the World Bank Mutual Investment Guarantee Agency by the US representative to the Agency. He stated that the research findings were essential to the development of these questions. After communications between the US representative and MIGA officials, the proposal to provide political risk guarantees to the UFS pulp mill expansion was dropped. Concerns about the project were shared by the State Department regarding one of the mill's financers, which was on a list of Chinese state enterprises subject to US sanctions.

World Bank Group

Informants from the World Bank Indonesia (Tom Walton, former Lead Regional Coordinator for the Environmentally and Socially Sustainable Development Department, and Tim Brown, Senior Natural Resources Specialist) have suggested that they had general awareness of the problems outlined in CIFOR's research, but that the data provided helped to confirm their perceptions. The Bank officials reported that they attempted to use the data in efforts to convince the Indonesian Bank Restructuring Agency to radically restructure pulp processing overcapacity, but with little success. Dr Walton also suggested that CIFOR's findings helped to confirm World Bank Indonesia's opposition to the proposed UFS mill, which was communicated by the Country Director to MIGA.

More generally, the World Bank's private sector arm, the International Finance Corporation's (IFC) forestry investment team credits CIFOR's research with raising awareness regarding the financial risks posed by environmentally unsound investments. Informants from the IFC credit the research with improving their disclosure of information regarding the social and environmental effects of forest sector investments.

European Union Forest Law Enforcement Governance and Trade Initiative

An official from the European Union's Directorate General for Development (Neil Scotland) reported that he included a bullet on 'Due diligence re financing, investment' in an Indicative List of Actions for the Implementation of the East Asia Ministerial Declaration on Forest Law Enforcement and Governance, as a direct consequence of CIFOR's research, which illustrated the lack of due diligence for prior pulp investments. To follow up on this recommended action, John Hudson of the UK's Department for International Development reports that DFID hired Chatham House to conduct a scoping study regarding how due diligence for forestry investments could be improved. Jade Saunders was the Chatham House researcher who conducted the work, and she reported that she found that 'due diligence' processes varied considerably by the type of finance, and there may be limited opportunities for European Union initiatives to affect the types of finance that result in wood processing overcapacity. Mr Scotland similarly reported that the EU has not followed up on this proposed area of action.

Private sector finance officials

Three former officials of banks with investments in APP were interviewed to discern whether CIFOR's research and the NGO advocacy that built upon it has affected their portfolios. Juhani Numminen, a former executive of Citibank, who regularly helped to appraise forestry investments, stated that NGO pressure regarding APP was not considered substantial in shifting bank due diligence practices, compared with other investments. However, in his present role with the European Bank of Reconstruction and Development, he uses the *Profits on Paper* report to illustrate to staff the necessity of adequate

fibre supply for pulp investments. A former ABN AMRO official similarly affirmed that NGO campaigns regarding APP were not a major influence on the bank, as the primary concern was the fact that debt owed by the company was unlikely to be recovered. Similarly, an HSBC official affirmed that in cases like that of APP, NGO and media campaigns influence the banking sector, but economic considerations are of primary concern when a company fails. None of the informants mentioned APP as a primary catalyst for sustainable forestry policies on the part of their banks. Thus, the effect of CIFOR's research on general 'due diligence' processes for private investments beyond Indonesia appears to be modest.

6 Counterfactual scenarios

This section attempts to infer plausible assumptions about likely counterfactual scenarios in the absence of CIFOR's research from the interview findings presented in Section 5, in terms of probable delays to observed improvements in policy and practice (for the main scenarios of this assessment). These assumptions are necessarily somewhat subjective, and will therefore be subjected to sensitivity analysis when scenarios are used in the economic analysis presented in Section 9.

6.1 Conservation set-aside commitments of APP and APRIL

Key informant interviews indicate that CIFOR contributed substantially to the environmental commitments undertaken by APP and APRIL in response to NGO advocacy. The two companies both cite CIFOR's direct influence, and the campaigns of WWF and FoE-EWNI as important to the environmental commitments undertaken beyond legal compliance. Moreover, those two NGOs, which were the only organisations (other than CIFOR) specifically mentioned as influential by the companies, both give substantial credit to CIFOR for enabling their pulp and paper campaigns. The role of the NGOs is represented in Figure 1. All interviewed informants from the two NGOs stated that in the absence of CIFOR's research, their advocacy would either not have been undertaken, or would not have had similarly persuasive evidence to offer until much later. For this reason, a plausible 'counterfactual' base scenario would be to assume that sufficient evidence to engender the environmental commitments generated thus far would have been available 3 years later. In turn, this will equate to a 3 year delay in increased conservation set-aside commitments in the main scenario developed later in this document.

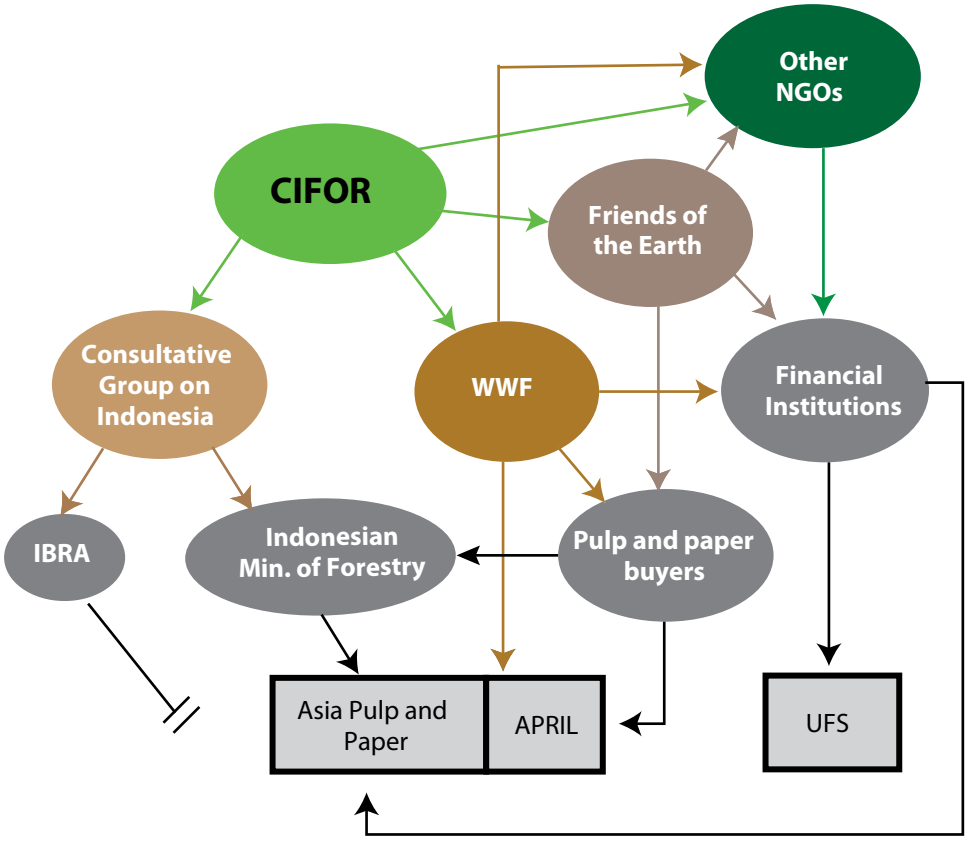

Figure 1. Key impact pathways for CIFOR's research on the Indonesian pulp and paper sector

6.2 Accelerated plantation development

Interview responses regarding effects on the set of Ministerial Decrees on acceleration of plantation development for the pulp and paper sector are less definitive. A number of NGO respondents interviewed believe that the Decree was influenced in response to their advocacy, and that their advocacy relied substantially on CIFOR's findings. However, the top Ministerial official interviewed suggested that contextual factors and changes within the Ministry were also important. At the same time, it was acknowledged that the loss of export market access (due largely to NGO advocacy that built on CIFOR's findings) was an important consideration in issuing the Decree. The fact that the pulp sector was chosen as the initial focus for the Decree, when it was not the sector facing the greatest reliance on unsustainable fibre sources, also appears to be indicative of influence.

It should also be noted that the accelerated plantation establishment rate observed may also be partially directly attributable to CIFOR. APP accounts for most of the observed increase in plantation establishment, and it began to state increased commitment to large-scale plantation establishment in a 'Sustainable Wood Supply Assessment' that was developed on the stated basis of responding to CIFOR's research. Thus, it appears likely that some of the

accelerated plantation development may be jointly attributable to CIFOR and to the Ministerial Decree, which was indirectly influenced by CIFOR. However, given the additional uncertainty that surrounds this pathway, the base counterfactual assumption will be a 2 year delay in the portion of accelerated plantation development deemed attributable to these two influences.

6.3 Averted pulp processing capacity expansion

To a large degree, the fact that there has not been major expansion in Indonesia's pulp processing capacity since the release of CIFOR's research may be attributable to the perceived risk of the sector since APP defaulted on its massive level of debt. However, interview responses indicate that CIFOR also made important contributions to this phenomenon. CIFOR's research helped to mobilise NGO campaigns that attracted an entire consortium of organisations to advocate over pulp development in Indonesia, which became very active regarding the proposed UFS mill. In addition, key actors with peripheral influence over MIGA deliberations drew directly on CIFOR's insights for establishing their policy positions. However, it is impossible to verify the exact nature of influence over this decision, as it is confidential. Moreover, it is still possible that the mill will be built at some point in the future, as the company has delayed, but not rescinded, its plans to do so. Given this uncertainty, the base assumption will be a delay of one year attributable to CIFOR.

7 Estimating effects on natural forest clearance

7.1 Increased conservation set-asides

As noted previously, APP and APRIL have undertaken specific conservation commitments, which were stimulated as a consequence of NGO advocacy. This section outlines how attributable increases in conservation area will be determined.

7.1.1 APP

APP undertook, as per a letter of intent with WWF, HCVF assessment of four concessions, which led to the stated protection of 107 000 hectares of forest (as reported at the end of 2006). It is not clear what proportion of these areas would have been cleared in the absence of HCVF commitments, as no details of prior APP plans for the concessions are available. Indonesian law requires the set aside of 15% of concession area for conservation, and some portion of the set-aside may be considered 'unplantable'. In addition, it is possible that some proportion of the clearing in the HCVF areas was diverted to other concession areas, although APP's abrupt withdrawal from commitments to expand HCVF assessment plans in 2004 appears to indicate that the set-asides actually diminished clearing rates. To incorporate these caveats, the present analysis assumes that only 50% of the preserved area has not been harvested as a result of conservation commitments arising from HCVF assessment. Sensitivity analysis will be conducted with assumptions of 25% and 75% as well.

The fate of the standing forest is also somewhat unclear, as there have been moderate to high levels of loss between 2004 and 2006, as a result of inadequate protection of the areas by APP. Although the company has stated commitments to improved protection of the area, it is unclear how effective such measures

will be. As a result, the analysis takes the assumption that loss continues at rates observed to date – 5% annually, with sensitivity analysis at 3% and 7%.

7.1.2 APRIL

APRIL officials credit NGO advocacy with virtually all improvements in sustainability made since 2001. Yet, data provided by the company indicate that conservation set-asides were rising as a proportion of concession area even prior to the research. At the same time, the rate of increase has risen subsequently from an average increase of 0.71% of concession area per year between 1997 and 2001 (from 14.0 to 19.7%) to an average increase of 1.4% from 2001 to 2007 (from 19.7 to 28.2%). The 43% increase in the proportion of concession area devoted to conservation results in 57 000 additional hectares set aside.

To investigate whether the increase in growth in the proportion of conservation area set aside after the research is statistically significant, the annual set-aside percentages were subjected to the 'Chow Test' (Chow 1960). This is a test for whether the coefficients in two linear regressions on separate subsamples are equal. The test statistic is calculated by performing linear regressions on the two subsamples, and calculating the sum of squares of the residuals for each sample assuming equal coefficients for each (in this case the regression results for the entire period), and the sum of squares of the residuals using unique coefficients for each subsample (the regression results for each subperiod). The ratio of the difference between the two sums of squares to the sum of squares of the residuals adjusted for the corresponding degrees of freedom gives the F statistic. The results of the Test ($F=12.3$) indicate that the growth rates in the proportion of conservation set-aside rose significantly ($P=0.01$) after the research and advocacy (from 2001 to 2007) as compared with the prior period (from 1993 to 2001). This supports the contention that increases in the growth of set-aside rates may have resulted from the work of CIFOR and advocates that used the research findings.

To be conservative, the present analysis assumes that, in the absence of NGO advocacy, APRIL's proportion of concession area devoted to conservation would rise at a slightly higher rate than it had historically between 1993 and 2001. This analysis assumes that a proportion of the balance, due to the subsequent increase in rate of growth in proportion of concession area can be credited to advocacy. The total area of additional set-aside attributable to the growth in the rate of increase of the proportion of concessions devoted to conservation reaches 28 200 hectares by 2007. In the main scenario, 75% of this increase is credited to advocacy, while sensitivity analysis lowers this to 50% and raises it to 100%. Only the incremental increase observed to date is used in the analysis (i.e. no further attributable increases in set-asides are projected).

For both companies, the assumed rate of loss in the absence of HCVF commitments is 20% of the total maximum area protected per year until the total area assumed to be protected is lost in the main scenario. The conservative scenario lowers this to 15%, whereas the liberal scenario raises this to 25%. The difference between this higher rate of clearing and the lower attrition rate from conservation set-asides is considered to be the natural forest clearance avoided by the conservation commitments, as outlined in Table 1. According to these scenarios, the actual peak natural forest clearance avoided as a result of advocacy ranges between 33 000 and 102 000 hectares. Although these areas may appear to be large, they are a fraction of the 175 000 additional hectares devoted to conservation within APP's and APRIL's concessions as a result of higher proportions of area devoted to this purpose.

7.2 Averted natural forest clearance effects of accelerated plantation development

The rate of plantation establishment has risen markedly since initial discussions of the Decree in 2002 and its issuance in 2003. Prior to the Decree, the annual rate of new plantation establishment was increasing at a moderate average rate of 2880 additional hectares of expansion per year, or a 5% average increase in the rate of expansion per year. In the years after CIFOR's research, annual first rotation planting rates have risen by an average of 17 400 hectares or 25% of the 2001 value per year.

To determine whether the increase in growth rate of new plantation establishment observed after 2001 is statistically significant, the Chow Test (described in Section 7.1.2) was applied. The F statistic calculated through the test (17.5) suggests that the rate of growth after the research (from 2001 until 2006) has accelerated significantly (P=0.01) compared with the prior period (from 1997 to 2001).

At the same time, the pulp processing capacity of the two major companies targeted by the Decree has remained higher than plantation-based fibre supplies, but has not risen. Thus, it can plausibly be assumed that the acceleration of plantation establishment rates will lead to greater availability of plantation-based fibre supplies, which should displace the consumption of mixed tropical hardwoods from natural forests. The net result of such acceleration could therefore be reduced natural forest clearance.

The contribution of the Decree to the accelerated plantation establishment rates is difficult to discern. APP's materials regularly mention the Decree (for example, it is discussed in APP 2006), and a key company official has noted that it has set an important internal target for the company. APRIL officials affirmed less influence.

In the legal context of Indonesia, regulations and government targets shift frequently. Thus, there is considerable uncertainty about whether companies

Table 1. Three scenarios of the effects of increased conservation set-aside commitments on the amount of natural forest remaining within the set aside areas

Year	Main scenario			Conservative scenario			Liberal scenario		
	Actual forest remaining in logable set-aside areas	Forest remaining without conservation commitments	Net conservation	Actual forest remaining in logable set-aside areas	Forest remaining without conservation commitments	Net conservation	Actual forest remaining in logable set-aside areas	Forest remaining without conservation commitments	Net conservation
2002	80 183	80 019	165	55 422	55 340	82	116 744	116 470	275
2003	80 183	79 819	364	55 422	55 240	182	116 744	116 138	606
2004	80 183	67 149	13 034	55 422	48 610	6 812	116 744	92 563	24 182
2005	77 411	52 120	25 291	53 481	40 814	12 667	112 586	65 171	47 415
2006	74 638	38 308	36 331	51 541	33 641	17 900	108 427	39 923	68 504
2007	67 360	24 836	42 524	44 667	26 941	17 726	103 802	13 973	89 830
2008	64 544	11 927	52 617	41 996	20 641	21 355	102 041	0	102 041
2009	61 851	0	61 851	39 488	14 718	24 770	100 312	0	100 312
2010	59 275	0	59 275	37 133	9 148	27 984	98 614	0	98 614
2011	56 811	0	56 811	34 921	3 910	31 011	96 946	0	96 946
2012	54 453	0	54 453	32 843	0	32 843	95 309	0	95 309
2013	52 198	0	52 198	30 891	0	30 891	93 701	0	93 701
2014	50 041	0	50 041	29 058	0	29 058	92 122	0	92 122
2015	47 976	0	47 976	27 336	0	27 336	90 571	0	90 571
2016	46 001	0	46 001	25 718	0	25 718	89 048	0	89 048
2017	44 111	0	44 111	24 197	0	24 197	87 553	0	87 553

not in compliance with the Decree as of 2009 will actually be subject to substantial penalties. For this reason, the analysis assumes that conversion will not be halted after 2009. The influence of the Decree is assumed to be 35% of the acceleration in first rotation planting (i.e. expansion of plantation area) observed since the Decree's issuance for APP and APRIL, the two companies that account for 90% of the pulp production capacity directly targeted by the 2003 Decree.

It appears that, in actuality, the effects of the Ministerial Decree cannot be distinguished from the direct influence of CIFOR's research, as the latter was the impetus for much greater attention to the development of plantation-based fibre supplies for the companies, as evidenced by the explicit discussion of CIFOR's findings as the basis for APP's initial Sustainable Wood Supply Audit (AMEC 2001). This Audit became the basis for much more explicit consideration and dialogue about APP's plans for a plantation-based source of fibre. Similarly, APRIL officials acknowledge that CIFOR has played an important role in promoting internal recognition of the importance of the development of a sustainable wood supply. With this recognition, the accelerated planting rates that can be observed from 2002 onwards can be plausibly considered to be influenced by CIFOR both directly and indirectly through the Ministerial Decree.

As described in more detail in Section 8, accelerated plantation development is beneficial because it may help to avert natural forest clearance, through increased availability of plantation-based fibre supplies, which substitute for fibre consumed at the expense of natural forest. However, it may not be self evident that such is the case in the context of Indonesia, where the stated justification for the clearance of natural forest in pulp concessions is for plantation development. In fact, if historically all natural forest areas cleared were promptly replanted with plantations, and plantations are only developed in areas from which natural forest is cleared, acceleration of plantation development would effectively accelerate natural forest clearance.

However, analysis of actual fibre sourcing patterns and plantation expansion rates reveals a different pattern. If it is assumed that average yields from natural forest clearance are stable at 130 cubic metres per hectare, the area of natural forest cleared historically for feeding APP's and APRIL's mills has far exceeded the area of new plantation established (see Fig. 2). It should also be noted that if cleared areas are not quickly planted, invasion by pioneer species and local communities often creates difficulties for subsequent planting.

From 1999 through 2001, the area cleared was nearly 50% more than the area planted each year. As planting rates rose at an increasing rate in subsequent years, the area cleared actually fell. This, in fact, corresponds with the fact that some new plantation areas are being developed in bareland areas, such as APP's initiation of planting in a new concession in South Sumatra.

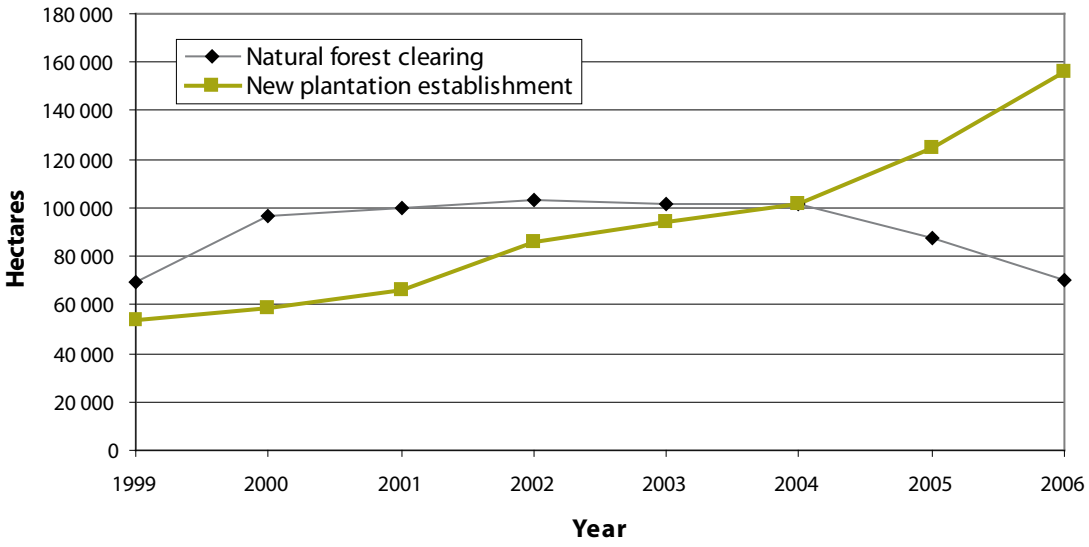

Figure 2. Indicative annual natural forest clearance rates and rates of plantation establishment by APP and APRIL (calculations by the author based on mixed tropical hardwood consumption and planting reported in AMEC 2001, APP 2007; Barr 2001; APRIL 2003, 2004, 2006; Virta 2006)

Hence, accelerated plantation development does not appear to be associated with accelerated short-term natural forest clearance. This is particularly true for the last marginal increments of acceleration, since the companies prefer to establish plantations in areas with natural forest cover, as wood is generated for fibre supplies at minimal cost during forest clearance. As a result, given mixed development in forested and bare areas, bare areas will be the least favoured areas to be planted. This means that the effects of acceleration of plantation development at the margin are more likely to be in the nonforested areas. As a result, it is plausible to assume that acceleration in plantation development reduces demand for clearing of natural forest for fibre by providing a more sustainable substitute. Given that the pulp mills need to run at near capacity to be profitable, and that there would likely be political fallout of mill closure, in the absence of accelerated plantation development, it is likely that additional access to natural forest fibre would be provided to keep the mills running at capacity, because of the capital investments involved.

To explore the effects of increased planting rates, planting and age class data provided by the companies have been compiled for 1997–2006 (based on company presentations, data provided to CIFOR and data reported in Sustainability Reports), and were adjusted to reflect first and second rotation planting. Planting data for the years up to (and including) 2000 were sourced from Barr (2001) for both companies. Subsequent planting rates for APP were derived from a table on plantation stand structure reported within a presentation package provided by the company (APP 2007), with adjustment for replanting based on reported volumes of harvested plantation fibre. APRIL figures subsequent to 2000 were calculated on the basis of planting figures reported in 'Sustainability Reports' for 2002, 2004 and 2006 (APRIL 2003, 2004, 2006). To reflect a gradual shift towards shorter rotation lengths (due to

improved genetic material), a 7 year rotation is assumed for initial plantings, and a 6 year rotation is assumed for replanting.

The average annual rate of first rotation plantation establishment is extrapolated to expand linearly at the average rate observed for 2001–2006, until there is sufficient area to support a production capacity of 5 million air-dried tonnes of pulp, under the 'with decree scenario'. This is compared with a scenario of growth in annual establishment equal to the average rate of increase for 1997–2001, so as to quantify the increase in plantation area attributable to acceleration in the rate of plantation expansion.

It should be noted that there is considerable uncertainty about the degree to which observed accelerated planting has resulted from the Ministerial Decree and NGO pressure, and the degree to which it is the natural result of increasing scarcity of natural forest-based fibre. For the purpose of this analysis, the main assumption is that 35% of the acceleration has resulted from these influences. Sensitivity analysis is conducted with values of 20% and 50%. This results in the series of plantation development scenarios presented in Figure 3.

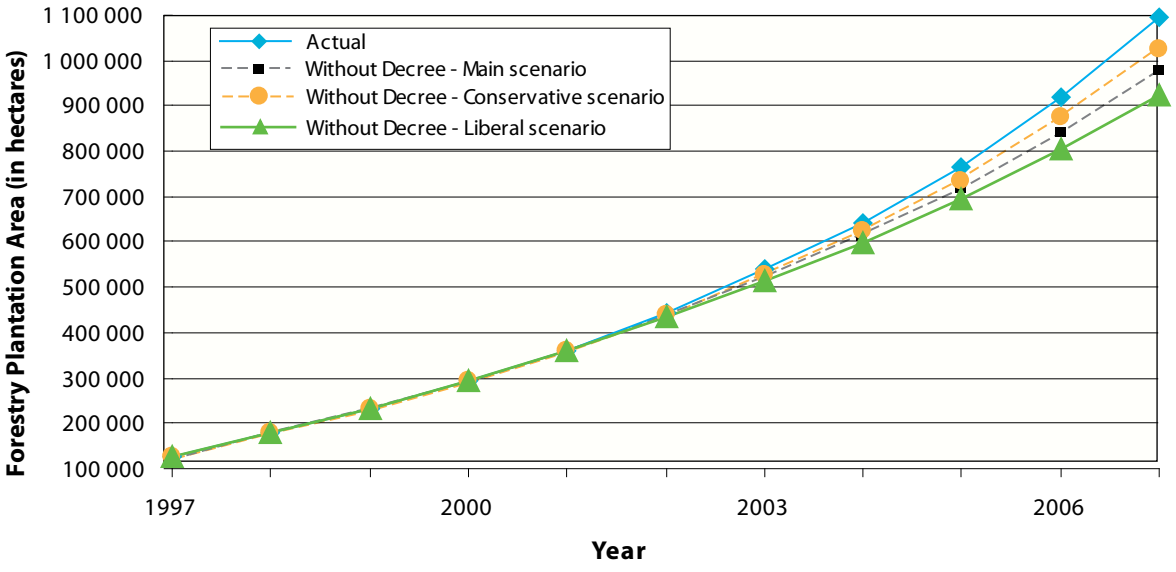

Figure 3. Scenarios of plantation area actually established by APP and APRIL and under different scenarios in the absence of NGO pressure and the Indonesian Ministerial Decree on acceleration of plantation development for the pulp sector

The quantity of plantation-based wood available as a result was calculated using the following formula:

$$p_t = a_{t-q} y (1-l) d_{pw} / c$$

where
p_t = tonnes of air-dried pulp from plantations in year t
a = area planted (hectares)
t = year

q = rotation period
y = yield (cubic metres per hectare)
l = proportion of losses
d_{pw} = density of plantation wood (green metric tonnes of wood per cubic metre)
c = conversion ratio (green metric tonnes of wood / air-dried metric tonnes of pulp)

An average plantation yield of 176 cubic metres per hectare was used, based on a weighted average of figures reported for the two companies in Pirard and Irland (2007). The assumed loss rate to the mill gate is 25%, and the average density of plantation-sourced *Acacia* and *Eucalyptus* is 1.142 cubic metres per green metric tonne. The average wood density of mixed tropical hardwood is estimated to be 25% higher, at 0.857 cubic metres per green metric tonne. A conversion ratio of 4.3 green metric tonnes of fibre to 1 air-dried tonne of pulp is used.

To convert fibre-sourced pulp into averted natural forest clearance, the following formula was used:

$$f_t = \frac{(v_t - p_t)c / d_{nw}}{n}$$

where
f_t = hectares of averted natural forest clearance in year t
v_t = total pulp processing capacity (tonnes) in year t
n = average net yield of wood sourced from natural forests (cubic metres per hectare)
d_{nw} = average density of wood from natural forest

The total pulp processing capacity assumed for APP and APRIL is 4.5 million tonnes per year up until 2008. As APRIL has stated intentions to expand its pulp mill in Kerinci by 0.5 million tonnes in the near future, subsequent capacity is assumed to be 5.0 million tonnes per year. Wood yields from the natural forest are highly variable, but are generally high, as there is generally no minimum log diameter for processing into pulp. For this analysis, 130 cubic metres per hectare is assumed as the average yield after losses. It should be noted that the lower the assumed yield, the higher the area of averted natural forest clearance will be. Thus, this high assumed density yields relatively conservative estimates of avoided forest loss.

This simple analysis does not take into account the effects of present (as of late 2007) police investigations in Riau, which have reportedly caused the two companies to suspend the clearing of natural forest areas and rely entirely on plantation-based fibre supplies for nearly a year. It has been reported that the companies have begun to prematurely harvest plantations, so as to keep the mills supplied at capacity. However, no reliable data have been available to determine the ultimate effects that this will have for future availability of plantation-sourced fibre.

This analysis yields the results presented in Table 2. Between 4.1 and 9.9 million cubic metres of wood consumption from clearing of natural forest areas is averted as a result of the assumed contributions of research and advocacy to acceleration of plantation development. As a result, between 32 000 and 76 000 hectares of natural forest areas are no longer cleared by 2013.

Table 2. Estimates of the effects of accelerated plantation development attributable to CIFOR's research, civil society advocacy and a Ministerial Decree on acceleration of plantation development for the pulp and paper sector

Year	Averted wood consumption from natural forests by APP and APRIL (cubic metres)			Area of averted forest clearing for fibre for APP and APRIL (hectares)		
	Main scenario	Conservative scenario	Liberal scenario	Main scenario	Conservative scenario	Liberal scenario
2009	687 396	392 798	981 995	5 288	3 022	7 554
2010	979 108	559 491	1398 726	12 819	7 325	18 313
2011	1727 281	1199 206	2255 355	26 106	16 550	35 662
2012	2828 125	1960 293	3695 958	47 861	31 629	64 093
2013	265 521	0	1601 559	49 903	31 629	76 412
2014	0	0	0	49 903	31 629	76 412
2015	0	0	0	49 903	31 629	76 412
2016	0	0	0	49 903	31 629	76 412
2017	0	0	0	49 903	31 629	76 412

7.3 Averted capacity expansion

A third set of averted natural forest clearance figures can be derived from averted expansion of pulp processing capacity. While it is impossible to estimate precisely how much total capacity would have expanded without CIFOR's research and subsequent advocacy, as noted in Section 6.3, the 600 000 tonne UFS Mill that has not been built may be a more concrete example of avoided capacity development. Jurgens *et al.* (2005) provide estimates of potential fibre supply shortages that the mill would have faced in 2009 and 2011, based on growth projections reported in an independent consultancy assessment. The present analysis assumes that half of the deficit would have been met by use of mixed tropical hardwoods carried on the company's balance sheet as an asset, and that an average yield of 130 cubic metres per hectare could be obtained from the natural forest area after losses.

The result of this analysis is that between 1.5 and 4.4 million cubic metres of wood will not be consumed from the natural forest if the advocacy generated to date actually prevents the mill from being built (Table 3). Following such assumptions, between 11 000 and 34 000 hectares of natural forest clearance will be avoided. However, UFS has not formally announced that it has rescinded plans to develop the mill. For this reason, the present analysis can only actually assume with some confidence that the mill has been delayed.

Thus, the primary benefit of research and advocacy has been to preserve the area of forest identified for an additional 3 years, by delaying finance of the mill from 2004 until at least late 2007.

Table 3. Wood consumption from natural forests and natural forest clearance avoided as a result of delays in approval of finance attributable to advocacy for the proposed UFS mill in Kalimantan

Year	Averted wood consumption from natural forests by UFS mill (cubic metres)			Area of averted clearing of natural forest for fibre for UFS mill (hectares)		
	Main scenario	Conservative scenario	Liberal scenario	Main scenario	Conservative scenario	Liberal scenario
2009	1238 095	619 047	1857 142	9 524	4 762	14 286
2010	1550 000	775 000	2325 000	21 447	10 723	32 170
2011	150 000	75 000	225 000	22 601	11 300	33 901

8 Valuation framework

The previous section identified overall consequences of changes in practices associated with CIFOR's research and related advocacy and policy reforms in physical terms. However, as these outcomes are not of intrinsic value, the benefits associated with these changes still need to be identified.

As noted previously, Indonesian pulp producers do not need to pay the full market price, let alone social cost, for wood consumed from natural forests in their concessions. Current royalties only reflect 10% of the government-determined reference price for wood volumes, or about $4 per cubic metre (according Ministry of Forestry Decree no. P.18/Menhut-II/2007), whereas international market prices, net of harvesting and transport are at least $30 for pulpwood.

This constitutes an implicit subsidy[10] to the pulp concessionaires. Such a subsidy implies that the marginal value of the wood produced is less than the marginal cost of its production. This implicit subsidy is in addition to external environmental costs that the consumption of mixed tropical hardwood imposes on the rest of society. This leads to efficiency losses, as the government's resources and the rest of the society expend costs to make up the difference.

The pulp industry is also affected by distortions that increase the demand for mixed tropical hardwood, as tax incentives, subsidised credit and capital subsidies cause overcapacity in the processing sector, which artificially inflates demand for wood from natural forests (Barr 2001).

[10] The definition of 'subsidy' used in economics is applied here, which includes the provision of government goods at below market prices. This differs from the narrower definition used by the World Trade Organization's Agreement on Subsidies and Countervailing Measures, which is premised on a 'financial contribution by a government or any public body' that requires a charge on the public account (SCM Article 1.1; cited from WTO 2006).

Figure 4 depicts this effect graphically (as adapted from Norton and Alwang 2004). A socially optimal market equilibrium would occur at point *a*, the intersection of Ps and Qs. Implicit subsidies that lower the price of mixed hardwood shift the supply curve down, and the noninclusion of environmental costs shifts the supply curve further down, relative to the curve where supply equals marginal social costs, so that the new curve is Sp. Subsidies to fibre processing capacity, such as access to subsidised finance and other capital subsidies highlighted by Barr (2001), have shifted the input demand curve to the right (Dp), so that a new equilibrium occurs at *g*, the intersection of Dp and Sp (or Qp and Pp). This new equilibrium results in deadweight losses of triangle *abc*, as this represents the area between the values that consumers place on production and the marginal social cost incurred.

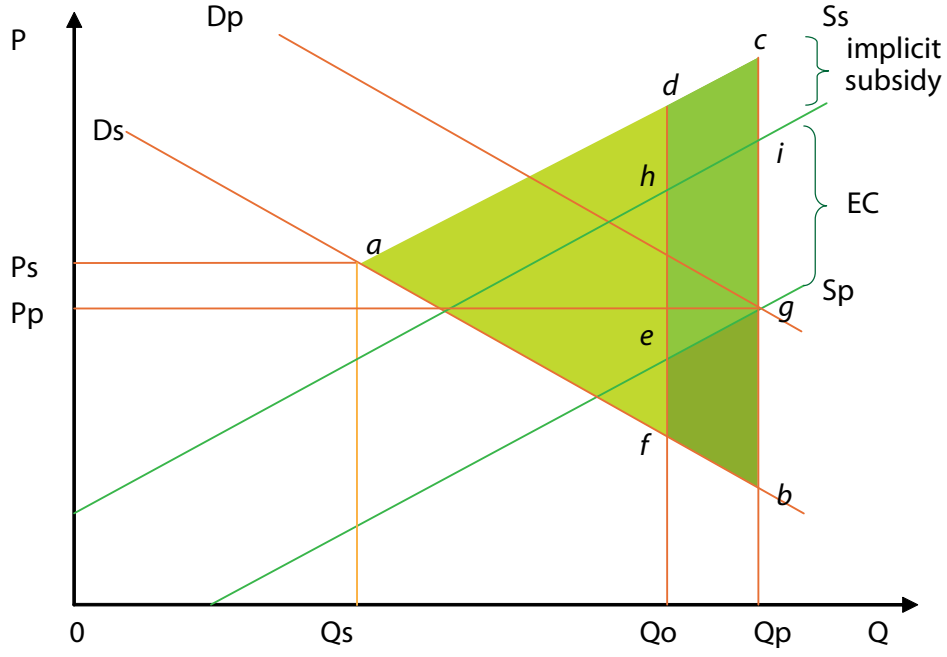

Figure 4. Economic surplus framework for valuation of reduced consumption of wood from natural forests in the presence of externalities and implicit subsidies (after Norton and Alwang 2004) – see text for explanation

By reducing the pulp industry's reliance on mixed tropical hardwood from natural forests, the equilibrium quantity of natural forest wood consumed is reduced from Qp to Qo. The economic surplus gain resulting from the shift is represented by the trapezoid *cdfb*.

Given limited cost and pricing data for the companies, points *f* and *b* are difficult to determine, so the full economic surplus gain cannot be calculated. However, the parallelogram *cdeg* can be approximated with available data. This parallelogram consists of two components: (1) the parallelogram *cdhi*, which can be approximated as the reduction in the quantity of natural forest wood consumed, multiplied by the unit subsidy; and (2) the parallelogram

egih, which consists of the external environmental costs per unit of natural forest consumed, multiplied by the reduction in consumption. The latter can also be conceptualised as the external environmental cost per hectare of forest clearance, multiplied by the area of natural forest clearance averted.

8.1 Reduction in consumption of implicit subsidy

An exact level of subsidy incurred is difficult to determine, due to the variability of wood stocks in standing natural forests within the concessions. Mixed tropical hardwoods can have higher values for pulp than do the *Acacia* species prevalent in Indonesian pulp plantations, as a result of a lower conversion rate between wood biomass and pulp. However, to be conservative, the present analysis assumes an implicit subsidy of $7 per cubic metre, based on the difference between plantation production costs for an equivalent standing volume ($11; based on calculations from Virta 2006; Nawir *et al.* 2007) and the actual royalty paid ($4). In addition, larger diameter logs with much higher values (>$100 per cubic metre) have been reported to be harvested in forests cleared for pulp plantation development, and sold on to plywood mills and other purchasers (Hardiono *et al.* 2003). However, given that no reliable data are available regarding such sales, this analysis assumes that all wood is processed into pulp.

8.2 Valuation of averted natural forest clearance

To apply the framework presented above, the divergence between the marginal social cost of natural forest conversion and the unsubsidised marginal private cost of conversion should be estimated, in addition to the reduced consumption of implicit subsidies. This divergence results from the loss of nonmarket values with public good characteristics, which are not reflected in the profit function of an individual firm.

Attempts to assess the Total Economic Value of forest resources have identified four sets of economic values that natural forests provide: (1) direct use values such as timber and non-timber forest products, (2) indirect use values, which include water regulation and carbon sequestration; (3) option values; and (4) existence values. Of these, only direct use values are likely to be reflected in a firm's marginal private cost. The present analysis attempts to identify values for climate, watershed and biodiversity services, which fall in the latter three categories.

Although ostensibly the purpose of clearing natural forest for pulp is to obtain land for plantation development, as illustrated in Section 7, clearing rates have historically been much higher than plantation establishment rates. Thus, in actuality, a variety of land uses may follow forest clearance. Initially, the land will be invaded by grass and shrub species, and if left undisturbed, will gradually revert to secondary forest. In some cases, in accessible mineral soil areas, if the cleared area is not guarded, local communities will invade and initiate low-intensity agricultural production in these areas. If soils become

degraded and fire is applied repeatedly to clear fields, this may lead to invasion by noxious weeds, such as *Imperata cylindrica*, which already render over 8 million hectares of Indonesia as 'wasteland' (Garrity *et al*. 1996; Otsamo 2001). As discussed later, a large proportion of concession area is on deep tropical peat soils, where forest regeneration is particularly slow, and when exposed to fire, clearance will be followed by a prolonged state of sedge (Cyperaceae) grassland (Giesen 2004).

The effect of accelerated plantation development has been to reduce the gap between forest clearing and plantation establishment, and thereby ensure greater plantation-based fibre supplies in the future. Thus, it is likely that the marginal natural forest clearance averted would be areas of future excess clearing, which would have resulted in a mixture of shrubland, grassland and agriculture. Thus, the approach taken to assess environmental benefits is an analysis of nonmarket benefits that would be lost after such conversion, using parameters representative of conditions in Sumatra, to the degree that such have been documented previously.

Given the uncertainties associated with nonmarket valuation, the present analysis can only offer rough and indicative values based on previous literature. It should be stressed that this analysis does not pretend to be precise. Rather, the intention is to offer some notional estimates of the environmental values associated with the conservation of natural forest that would otherwise be lost.

8.3 Indirect use values

8.3.1 Watershed services

Natural forests provide water regulation, storage and quality enhancement, which benefit agriculture, fisheries and human health. Natural forests have extensive systems of roots and microorganisms in the rizosphere, which increase soil porosity and water retention capacity. This results in slow water release after precipitation has ceased, which mitigates drought effects, and contributes to water quality through reduced siltation. SCBD (2001) note estimated values ranging from $15 to $850 per hectare per year for watershed benefits of tropical forests. In van Beukering *et al*.'s (2003) analysis of the Total Economic Value of Leuser National Park, 49% of conservation benefits arise from flood prevention, fisheries protection and water supply services, which collectively equate to a discounted benefit of over $150 per hectare per year. In the present analysis, it is assumed that the additional watershed benefits of forest cover equate to $30 more per hectare per year than would be the case under a mixture of shrubland, agriculture and grassland in the main scenario. Sensitivity analysis will use values of $20 and $40.

8.3.2 Carbon sequestration

Forests offer climate services, both through sequestration in aboveground biomass, and through retention of previously sequestered carbon below ground. Sequestration rates in aboveground biomass vary widely, and often decline as an undisturbed forest ages and becomes dominated by late successional species. Given the wide range of sequestration rates that may be possible in forested areas and after conversion, it is not possible to reliably estimate the average expected difference in marginal sequestration rates. However, it is unlikely that sequestration rates under nonforest land use would exceed those of the cleared forest.[11]

However, forest vegetation also contains previously sequestered carbon in aboveground biomass, which can be more reliably estimated. Palm *et al.* (1999) observe carbon stocks in primary Indonesian forests at levels as high as 373 tonnes per hectare. For this analysis, an average carbon stock level of 200 tonnes per hectare will be assumed, and avoided release will be averaged over the 20 year period of analysis for analytical simplicity. Thus, the average annual avoided carbon release from avoided natural forest clearance is 10 tonnes per hectare from aboveground biomass in the main estimate. Sensitivity analysis will lower this to 7.5 and raise it to 12.5. Given that one tonne of carbon equates to 3.67 tonnes of carbon dioxide upon oxidation, this means that 37 fewer tonnes of carbon dioxide are released from biomass for every hectare of forest conserved in the main scenario (28–46 tonnes under sensitivity analyses).

This is in addition to avoided release from below-ground biomass. Although such release is minor for natural forest clearance on mineral soils, it is substantial for tropical peatlands. Tropical peat contains 600 tonnes of carbon per hectare for each metre of peat depth (Page *et al.* 2002), which is gradually released if the peat dries. Natural peat 'domes' have water tables near to the peat's surface, but clearance and conversion of tropical peat forests leads to drying, as canals are often established to transport harvested wood, and the absence of vegetation allows greater loss of moisture through evaporation.

Hooijer *et al.* (2006) provide a detailed assessment of carbon dioxide emission from drained peatlands in Southeast Asia, and they find that each centimetre of peat drainage causes the annual release of 0.91 tonnes. They further find that this equates to an average 'likely' annual emission of 48 tonnes of carbon dioxide per hectare for peatland converted from forest to 'mixed cropland/shrubland and small-scale agriculture', under an average drainage depth of 53 centimetres. Under sensitivity analysis, values of 36 and 60 tonnes annually will be applied.

11 The types of vegetation common in the land uses that follow forest clearing, such as mixed shrubland, Cyperaceae or sheet *Imperata* have minimal sequestration rates (Palm *et al.* 1999). It should also be noted that where vegetation is subjected to regular disturbance, much of the sequestered carbon content in the cleared plant material is ultimately oxidised and released back into the atmosphere.

When peat dries, it also becomes more susceptible to fire. If fire occurs, much higher carbon releases will take place, with releases of up to 2400 tonnes of carbon dioxide per hectare (Parish and Canadell 2005). The present analysis assumes that peat areas have a 0.5% chance of burning after clearance, which yields an average expected release of 12 tonnes. Sensitivity analysis will use assumptions of 0.25% and 1% annual fire risks, or 6 and 24 tonnes, respectively.

It is difficult to reliably value averted carbon emissions from forests, as they are not eligible for financing in current carbon markets. For reference, the 2006 prices of carbon for certified emission reduction of one tonne of carbon dioxide ranged from 5 euros (US$ 7) for higher-risk forwards to 10 euros (US$ 14) for low-risk forwards (Capoor and Ambrosi 2007). In terms of marginal damage, Tol (2005) finds a mean reported value of $25 per tonne. A price of $5 is used in the present analysis based on this set of abatement and damage costs.

Thus, the total average sequestration and averted emission of carbon dioxide is calculated to be 37 tonnes per hectare per year for forest on mineral soils, and 97 tonnes on peat soils of more than one metre depth, which is valued at $185 and $485 annually per hectare, respectively, for the main scenario. Under a conservative sensitivity analysis, these values drop to $140 and $350, respectively, whereas a liberal set of assumptions raises these values to $230 and $650.

8.4 Option/existence values

8.4.1 Biodiversity

The value of biodiversity essentially embodies the value of information generated through evolutionary processes over several billion years and the potential contribution of that information to ecosystem function and utilisation by humans. Tropical moist forests contain as much as half of all terrestrial biodiversity, and Indonesian moist forests are considered biodiversity 'hotspots'. In fact, the Tesso Nilo National Park, which has been established on former APRIL concession area, has been observed to be the most biodiverse terrestrial ecosystem in the world (Gillison 2001), with more than 200 plant species present in a single square metre.

Biodiversity is notoriously difficult to value economically, and as a result, there are relatively few empirical estimates for tropical forests, particularly values on an annual per hectare basis. Kumari (1995; cited in IIED 2003) applies a range of assumptions to calculate the bioprospecting value of Malaysian forest biodiversity for pharmaceutical use, and determines an annual value of $50 per hectare for a combination of middle range assumptions. Adams *et al.* (2007) find a similar annual value of $60 per hectare based on willingness to pay for tropical forest conservation in the Atlantic rainforest of Brazil. Both of

these are partial measures, and could be considered additive (with a total value of $110, if the forests were assumed to be similar), as the former is an option (potential use) value for medicinal applications, whereas the second primarily reflects intrinsic existence values and option values for recreation. Moreover, currently available methods for valuing biodiversity do not fully reflect the 'insurance values' of contributions to environmental resilience (SCBD 2001). In this analysis, an annual value of $50 per hectare is applied for the main scenario, with $25 and $75 applied in sensitivity analysis for the additional biodiversity conserved under natural forest cover, which would be lost after clearance.

8.5 Total values

The total environmental costs of natural forest clearance under the main set of assumptions is calculated to be $265 annually per hectare on mineral soils and $565 on peat soils, due to the high level of carbon storage (Table 4). A conservative set of assumptions results in values of $185 and $395, whereas liberal assumptions result in $345 and $765, respectively. These estimates are dominated by carbon values, which is in accordance with much of the literature on the economic values of forest environmental services (IIED 2003).

Table 4. Nonmarket external economic benefits from forests, as estimated in the present analysis for Sumatra and Kalimantan

	Annual economic values per hectare (US$)					
	Natural forest					
	Main scenario		Conservative assumptions		Liberal assumptions	
Option/existence value						
Biodiversity	50		25		75	
Indirect use value						
Water regulation	30		20		40	
Carbon sequestration	Mineral soil	Peatland	Mineral soil	Peatland	Mineral soil	Peatland
	185	485	140	350	230	650
Total value of external benefits	**265**	**565**	**185**	**395**	**345**	**765**

Given the large difference in values between forests on peatlands and those on mineral soils, to calculate the overall benefits of the areas of avoided natural forest clearance obtained in Section 7, it is necessary to identify the proportion of forest conserved on peatland. This is estimated on the basis of the proportion of deep peat soils in APP and APRIL's concessions. Data obtained from WWF indicate that 54 per cent of the area of the concessions for which peat statistics are available is on sites with greater than one metre of peat depth. Information provided by APRIL indicates that 40 per cent of the concession area is located on deep peat soils. The present study calculates a weighted average external environmental cost of clearing of $400 annually per hectare on the basis of an assumed 45:55 ratio of peat to mineral soils under

the main scenario. For comparison, conservative assumptions yield average external costs of $280 per hectare cleared, whereas liberal assumptions result in a $534 annual average per hectare cost. Under the main assumptions, if the average external environmental cost of clearing is calculated as a 20 year net present value with a discount rate of 5% and an assumed average natural forest wood yield of 130 cubic metres per hectare (after losses from bark, wastage and transport), this equates to $40 of external costs per cubic metre delivered to the mill gate.

9 Benefits attributable to CIFOR

9.1 Attributive assumptions

The benefits investigated thus far represent the effects of much more than just CIFOR's research, as they embed effects that can plausibly be attributed to increased attention to sustainability issues in the Indonesian pulp and paper sector, as a result of a range of advocacy activities by a number of civil society groups. Thus, the 'without CIFOR' counterfactual still needs to be generated to identify what benefits would likely have been generated with all of the other players still active, but CIFOR's research removed. This counterfactual will be applied to identify what proportion of these benefits should be attributed to CIFOR.

As noted in Section 6, this is premised on the following base assumptions of advancement of benefit flows:

- Increase in conservation set-asides – 3 year advancement
- Increased acceleration of plantation development – 2 year advancement
- Averted development of UFS mill – 1 year advancement.

Sensitivity analysis will be conducted with a one year decrease and a one year increase in these assumed periods of advancement.

For avoided natural forest clearance, the basic valuation framework consists of:

$$EV = \sum_{t=s}^{n} \frac{b(f_{ct} - f_{at})}{(1+r^t)}$$

where

EV = discounted external economic value
b = annual external benefit per hectare of forest

f_{ct} = counterfactual forest lost in year t
f_{at} = actual forest lost in year t
s = start year of benefit period
n = end year of benefit period
r = discount rate.

As noted in Section 8, these benefits are in addition to those that arise from avoided consumption of implicit subsidies. This is calculated via the following formula:

$$EV = \sum_{t=s}^{n} \frac{i(p_{at} - p_{ct}) * (d_{pw} / d_{nw})}{(1 + r^{t})}$$

where

i = the implicit subsidy per cubic metre of wood from the natural forest

p_{at} = the predicted increased volume of plantation wood, which will substitute for natural forest in year t

p_{ct} = the counterfactual increase in volume of plantation wood, which will substitute for natural forest in year t

d_{nw} = density of natural forest wood

d_{pw} = density of plantation wood.

It should be noted that the advancement of aversion of natural forest clearance for fibre provision will result in benefit flows that continue for as long as the forest remains conserved. Given that the clearance of the forest is often a permanent change, the increased area conserved in the initial years will continue to provide benefit flows for the duration that the forests remain.

Advancement in the increase of conservation set-aside commitments may also yield continual flows of benefits. These benefits are due to the fact that conservation set-aside commitments essentially serve to slow the rate of forest clearance. Under counterfactual assumptions of delayed set-aside commitments, the forest area cleared in the initial years before set-asides increase can no longer be protected. This means that the maximum area of set-aside will be reduced to the area remaining after additional years of clearing.

The present analysis includes only the benefits of averted consumption of implicit subsidies that stem from reduced consumption of natural forest fibre due to plantation acceleration. Advancement of conservation set-asides is not assumed to result in reduced consumption of natural forest fibre volumes, because the counterfactual assumption is that similar conservation commitments would have been generated at a later date in the absence of CIFOR. If such is the case, the total volume of fibre consumption may not be diminished. In addition, the UFS mill has been delayed, but has not yet been cancelled. This means that the natural forest fibre may still be consumed from affiliated concessions at a later date. For this reason, averted consumption of implicit subsidies by the mill is also excluded.

9.2 Identifying relevant costs

The direct costs of CIFOR's research on the Indonesian pulp and paper sector are relatively small, as much of the research is based on 'desk studies' and key informant interviews. However, as Raitzer and Kelley (2008) note, it may not be appropriate to evaluate the returns of investments in very specific research activities that are impact 'success stories', as the failure rate of research is often rather high. For this reason, a range of costs is used in the calculations. The main scenario uses a value of $500 000 per year for the research cost, which is an estimate that is 10 times higher than the direct research costs encountered for the studies, so as to encompass potential associated efforts that lack quantifiable impact. The 'liberal' scenario uses calculations based on the direct costs of the research activities, whereas conservative estimates apply half of the entire budget of the former 'Underlying Causes of Deforestation' programme for costs.

9.3 Research benefit estimates for 'main scenario'

Thus, the assumptions for the main scenario derived from the previous sections may be summarised as follows:

- 35% of acceleration in growth of annual plantation establishment rates is attributable to the Ministerial Decree and NGO advocacy;
- A 2 year advancement of this portion of acceleration is attributable to CIFOR;
- 50% of the area of APP's HCVF set-asides has been conserved as a result of NGO advocacy;
- There is 5% loss of forest from APP HCVF set-aside per year after 2006;
- 75% of the increased rate of growth in the proportion of APRIL's concessions set aside for conservation since 2001 is attributable to NGO advocacy;
- There is 3% loss of forest from APRIL conservation set-aside per year;
- A 3 year advancement of conservation commitments by the two companies is attributable to CIFOR;
- Half of the fibre shortfall predicted by Jurgens *et al.* (2005) for the proposed UFS pulp mill would be sourced from clearing of natural forest;
- A 1 year delay in the UFS mill project is attributable to CIFOR;
- The annual average net benefit of preservation of a hectare of forests is $400;
- The average implicit subsidy avoided due to accelerated plantation development for consumption of a cubic metre of fibre from natural forests is $7;
- Total relevant research costs equal $500 000 per year for 1998–2005;
- The base discount rate is 5%.

Under these assumptions, over a 20 year timeframe, $133 million of benefits is generated by $3.4 million dollars of investment (Table 5), with a benefit–cost ratio of 39:1, and an internal rate of return (IRR) of 65%. The benefits attributable to CIFOR comprise roughly half of the total $261 million value of improvements resulting from advocacy. The largest proportion of the benefits accrues from advancement of 80 000 hectares of conservation set-aside by 3 years, followed by preservation of the area of natural forest for which fibre from accelerated plantation development has substituted. Benefits realised by the end of 2006 total nearly $21 million, and arise from the advancement of conservation set-asides, with a benefit–cost ratio of 6.2:1.

9.4 Research benefit estimates under the 'conservative scenario'

To summarise the findings of the previous sections, the following assumptions are used in the conservative scenario:

- 20% of the acceleration in growth of annual plantation establishment rates is attributable to the Ministerial Decree and NGO advocacy;
- A single year advancement of this portion of acceleration is attributable to CIFOR;
- 35% of the area of APP's HCVF set-asides has been conserved as a result of NGO advocacy;
- There is 7% loss of APP HCVF set-aside per year after 2006;
- 50% of the increased rate of growth in the proportion of APRIL's concessions set aside for conservation since 2001 is attributable to NGO advocacy;
- There is 5% loss of APRIL conservation set-aside per year;
- A 2 year advancement of conservation commitments by the two companies is attributable to CIFOR;
- Potential benefits from the delay of the UFS mill project are excluded;
- The annual average net benefit of preservation of a hectare of forests is $280;
- The average implicit subsidy avoided due to accelerated plantation development for consumption of a cubic metre of fibre from natural forests is $7;
- Total relevant research costs equal 50% of the cost of the Underlying Causes of Deforestation programme for 1998–2002, plus $500 000 annually for 2003–2005;
- The base discount rate is 10%.

Under these assumptions, over a 20 year timeframe, $19.1 million of benefits is generated by $5.0 million dollars of investment (Table 6), with a benefit–cost ratio of 3.8:1, and an IRR of 27%. Benefits attributable to CIFOR comprise

Table 5. Economic benefits of gross changes to which CIFOR contributed under the main study scenario and benefits from advancement of changes, which may be attributed to CIFOR (all figures are in millions of US dollars, discounted at a 5% rate)

Year	Avoided natural forest clearance due to accelerated plantation development		Avoided subsidy			Increased conservation set-aside		Avoided natural forest clearance due to avoided overcapacity expansion			Total	Costs
	Gross benefits due to changes	Net benefits of accelera-tion	Benefits due to changes	Counter-factual	Diff.	Gross benefits due to changes	Net benefits of accelera-tion	Benefits due to changes	Counter-factual	Diff.		
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45
2001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43
2002	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.05	0.41
2003	0.00	0.00	0.00	0.00	0.00	0.11	0.11	0.00	0.00	0.00	0.11	0.39
2004	0.00	0.00	0.00	0.00	0.00	3.89	3.89	0.00	0.00	0.00	3.89	0.37
2005	0.00	0.00	0.00	0.00	0.00	7.19	7.14	0.00	0.00	0.00	7.14	0.36
2006	0.00	0.00	0.00	0.00	0.00	9.84	9.74	0.00	0.00	0.00	9.74	0.00
2007	0.00	0.00	0.00	0.00	0.00	10.96	7.60	0.00	0.00	0.00	7.60	0.00
2008	0.00	0.00	0.00	0.00	0.00	12.92	6.71	0.00	0.00	0.00	6.71	0.00
2009	1.24	1.24	2.81	0.00	2.81	14.47	5.97	2.23	0.00	2.23	12.25	0.00
2010	2.86	2.86	3.82	0.00	3.82	13.20	3.88	4.78	2.12	2.66	13.21	0.00
2011	5.54	4.42	6.41	2.55	3.86	12.05	3.55	4.79	4.55	0.24	12.07	0.00
2012	9.67	7.08	10.00	3.46	6.54	11.00	3.25	4.57	4.57	0.00	16.87	0.00
2013	9.60	6.74	0.89	5.82	0.00	10.04	2.98	4.35	4.35	0.00	9.72	0.00
2014	9.14	6.42	0.00	9.07	0.00	9.17	2.73	4.14	4.14	0.00	9.15	0.00
2015	8.71	6.12	0.00	0.81	0.00	8.37	2.50	3.94	3.94	0.00	8.62	0.00
2016	8.29	5.82	0.00	0.00	0.00	7.65	2.30	3.76	3.76	0.00	8.12	0.00
2017	7.90	5.55	0.00	0.00	0.00	6.98	2.11	3.58	3.58	0.00	7.65	0.00
Total		**46.24**			**17.03**		**64.52**			**5.13**	**132.92**	**3.39**

Table 6. Economic benefits of gross changes to which CIFOR contributed under the conservative scenario and benefits from advancement of changes, which may be attributed to CIFOR (all figures are in millions of US dollars, discounted at a 10% rate)

Year	Avoided natural forest clearance due to accelerated plantation development		Avoided subsidy			Increased conservation set-aside		Avoided natural forest clearance due to avoided overcapacity expansion			Total	Costs
	Actual	Net benefits of acceleration	Actual	Counter-factual	Diff.	Gross benefits due to changes	Net benefits of acceleration	Actual	Counter-factual	Diff.		
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94
2001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95
2002	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.02	0.51
2003	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.03	0.31
2004	0.00	0.00	0.00	0.00	0.00	1.08	1.06	0.00	0.00	0.00	1.06	0.28
2005	0.00	0.00	0.00	0.00	0.00	1.82	1.79	0.00	0.00	0.00	1.79	0.26
2006	0.00	0.00	0.00	0.00	0.00	2.34	1.45	0.00	0.00	0.00	1.45	0.00
2007	0.00	0.00	0.00	0.00	0.00	2.10	0.60	0.00	0.00	0.00	0.60	0.00
2008	0.00	0.00	0.00	0.00	0.00	2.31	0.37	0.00	0.00	0.00	0.37	0.00
2009	0.30	0.30	0.96	0.00	0.96	2.43	0.69	1.33	1.33	0.00	1.95	0.00
2010	0.65	0.38	1.25	0.88	0.37	2.50	0.59	3.00	3.00	0.00	1.35	0.00
2011	1.34	0.75	2.43	1.13	1.30	2.52	0.51	3.16	3.16	0.00	2.55	0.00
2012	2.33	1.11	3.61	2.21	1.40	2.42	0.36	3.16	3.16	0.00	2.87	0.00
2013	2.12	1.01	0.00	3.28	0.00	2.07	0.22	3.16	3.16	0.00	1.23	0.00
2014	1.93	0.92	0.00	0.00	0.00	1.77	0.19	3.16	3.16	0.00	1.11	0.00
2015	1.75	0.84	0.00	0.00	0.00	1.51	0.16	3.16	3.16	0.00	1.00	0.00
2016	1.59	0.76	0.00	0.00	0.00	1.30	0.14	3.16	3.16	0.00	0.90	0.00
2017	1.45	0.69	0.00	0.00	0.00	1.11	0.12	3.16	3.16	0.00	0.81	0.00
Total		**6.76**			**4.04**		**8.31**			**0.00**	**19.10**	**5.03**

roughly one quarter of the $76 million in benefits resulting from advocacy in this scenario. The largest portion of the benefits accrues from advancement of 55 000 hectares of conservation set-aside by 2 years, followed by accelerated plantation development. Benefits realised by the end of 2006 are estimated to be slightly lower than the programme costs applied.

9.5 Research benefit estimates under the 'liberal scenario'

To summarise the findings of the previous sections, the following assumptions are used in the liberal scenario:

- 50% of acceleration in growth of annual plantation establishment rates is attributable to the Ministerial Decree and NGO advocacy;
- A 3 year advancement of this portion of acceleration is attributable to CIFOR;
- 75% of the area of APP's HCVF set-asides have been conserved as a result of NGO advocacy;
- There is 2% loss of forests from APP HCVF set-asides per year after 2006;
- The increased rate of growth in the proportion of APRIL's concessions set aside for conservation since 2001 is attributable to NGO advocacy;
- There is 1% loss of forests from APRIL conservation set-asides per year;
- A 4 year advancement of conservation commitments by the two companies is attributable to CIFOR;
- 75% of the fibre shortfall predicted by Jurgens *et al.* (2005) for the proposed UFS mill would be sourced from clearing of natural forest;
- A 2 year delay in the UFS mill project is attributable to CIFOR;
- The annual average net benefit of preservation of a hectare of forests is $534;
- The average implicit subsidy avoided due to accelerated plantation development for consumption of a cubic metre of fibre from natural forests is $7;
- Total relevant research costs equal the direct costs of research on the Indonesian pulp and paper sector;
- The base discount rate is 2%.

Under these more speculative assumptions, over a 20 year timeframe, $583 million of benefits is generated by $390 000 dollars of investment (Table 7), with a benefit–cost ratio of 1512:1, and an IRR of 170%. The total benefits attributable to advocacy are estimated at $849 million, of which 69% is

Table 7. Economic benefits of gross changes to which CIFOR contributed under the liberal scenario and benefits from advancement of changes, which may be attributed to CIFOR (all figures are in millions of US dollars, discounted at a 2% rate)

Year	Avoided natural forest clearance due to accelerated plantation development		Avoided subsidy			Increased conservation set-aside		Avoided natural forest clearance due to avoided overcapacity expansion			Total	Costs
	Actual	Net benefits of acceleration	Actual	Counter-factual	Diff.	Gross benefits due to changes	Net benefits of acceleration	Actual	Counter-factual	Diff.		
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
2001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
2002	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.00	0.00	0.00	0.14	0.05
2003	0.00	0.00	0.00	0.00	0.00	0.29	0.29	0.00	0.00	0.00	0.29	0.01
2004	0.00	0.00	0.00	0.00	0.00	11.47	11.47	0.00	0.00	0.00	11.47	0.04
2005	0.00	0.00	0.00	0.00	0.00	22.04	22.04	0.00	0.00	0.00	22.04	0.04
2006	0.00	0.00	0.00	0.00	0.00	31.22	31.10	0.00	0.00	0.00	31.10	0.00
2007	0.00	0.00	0.00	0.00	0.00	40.14	39.87	0.00	0.00	0.00	39.87	0.00
2008	0.00	0.00	0.00	0.00	0.00	44.70	34.11	0.00	0.00	0.00	34.11	0.00
2009	3.24	3.24	5.53	0.00	5.53	43.08	27.17	6.14	0.00	6.14	42.08	0.00
2010	7.71	7.71	7.72	0.00	7.72	41.52	26.30	13.55	0.00	13.55	55.28	0.00
2011	14.72	14.72	12.20	0.00	12.20	40.02	25.47	13.99	6.14	7.86	60.25	0.00
2012	25.94	22.88	19.61	5.21	14.40	38.57	24.66	13.72	13.55	0.17	62.11	0.00
2013	30.32	23.05	8.33	7.27	1.05	37.18	23.87	13.45	13.99	0.00	47.98	0.00
2014	29.72	22.60	0.00	11.50	0.00	35.83	23.11	13.19	13.72	0.00	45.71	0.00
2015	29.14	22.16	0.00	18.48	0.00	34.54	22.37	12.93	13.45	0.00	44.53	0.00
2016	28.57	21.72	0.00	7.85	0.00	33.29	21.66	12.68	13.19	0.00	43.38	0.00
2017	28.01	21.30	0.00	0.00	0.00	32.09	20.96	12.43	12.93	0.00	42.26	0.00
Total		**159.39**			**40.91**		**354.57**			**27.71**	**582.58**	**0.39**

attributed to CIFOR. The largest proportion of the benefits accrues from preservation of the area of natural forest for which accelerated plantation development has substituted, as well as advancement of over 110 000 hectares of conservation set-aside by 4 years. Benefits realised by the end of 2006 total $65 million, and arise from the advancement of conservation set-asides, with a benefit–cost ratio of 169:1.

10 Discussion of results

10.1 Factors affecting the accuracy of estimates

Although the range of benefits is rather wide among the scenarios, the benefit values of the research are consistently much higher than the costs incurred for the assessed research. As Raitzer and Ryan (2008) note, there are only a handful of studies that have successfully identified the economic benefits of policy oriented research, which renders this a rather unique case. Moreover, most of the estimates from the present study lie at the upper end of prior estimates identified in Alston *et al.*'s (2000) comprehensive meta analysis of studies of the economic impact of technology oriented agricultural research.

Nevertheless, there is a great deal of uncertainty associated with these estimates, as evidenced by the fact that the 'liberal' benefit value is 30 times the 'conservative' estimate. This uncertainty stems from a number of sources. There is inherent subjectivity in attempts to identify the contribution of CIFOR's findings to subsequent actions by advocates and policy makers, and there is inherent subjectivity in identifying changes in action attributable to those intermediaries, as both rely upon data from interviews with informants who are likely to have various biases. To the extent possible, 'triangulation' has been attempted through document review and statistical tests, so as to validate informants' responses.

Additional uncertainty stems from the fact that forest resources are heterogeneous, and few reliable data are available regarding their attributes in concession areas. Compounding these complications is the fact that few reliable methods are available to value the most important nonmarket services that forests provide. In addition, a number of parameters rely on estimates published or provided by the pulp and paper companies, as there are no alternative data sources available and the cost of primary data collection is prohibitive. Hence, sensitivity analysis is used to explore the effects of the multiple sources of uncertainty to which the overall analysis is subject, and in aggregate, causes a rather wide distribution of potential benefit estimates.

Projected benefits comprise between 75% and 90% of the values estimated, which makes the estimates somewhat more uncertain. However, it should be noted that there has scarcely been sufficient time for the first plantations established since the research to come to maturity, as (at the time of writing) only 7 years have passed since the release of the initial CIFOR report on the pulp and paper sector. Thus, reliance on projections is somewhat unavoidable, particularly as even the natural forest clearance avoided to date creates benefits that flow well into the future. Nevertheless, it is impressive that under all but the most conservative of assumptions, benefit–cost ratios based on benefits realised to date are comparable with successful agricultural research cases (Alston *et al*. 2000).

While this study has shown that there has been important progress towards sustainability by the Indonesian pulp and paper sector, only a small proportion of the total economic costs to society posed by the industry's reliance on natural forest fibre have been alleviated. According to the calculations of the present study, even after CIFOR's influence, extensive NGO advocacy and action by the Ministry of Forestry, at least 721 000 hectares of natural forest will be cleared for pulp fibre sourcing between 2002 and 2011 by APP and APRIL, with associated discounted external costs of approximately $3.4 billion over a 20 year timeframe.[12] Moreover, many other industries outside of the pulp and paper sector collectively continue to consume much more wood from clearing of natural forest. Even the most generous of the estimates of averted natural forest clearance attributed to research and advocacy in the present assessment collectively amounts to less than 2% of the roughly 12 million hectares[13] of forest cleared between 2001 and 2007. Thus, the benefits attributable to CIFOR's research, though large in absolute terms, pale in comparison with the magnitude of the problems that remain.

10.2 Other impact pathways

It should be noted that even the most conservative of these estimates only partially accounts for the many impact pathways of CIFOR's pulp and paper research. For example, the series of Ministerial Decrees on acceleration of plantation development, which was first applied to the pulp sector in 2003, was gradually expanded, so that by 2005, it encompassed all 'primary wood product industries', which means that there may be many more averted natural forest clearance effects beyond the pulp sector.

During 2007, the Chief of Police in Riau initiated an investigation of APP and APRIL for operating under wood utilisation permits that contravene Ministry of Forestry regulations regarding the areas from which forest may be cleared for plantation development. This includes Decrees regarding the maximum

[12] This is under the assumption that no further expansion of pulp processing capacity beyond plantation-based fibre supplies takes place. If such expansion were to happen, the external cost would be higher.

[13] This figure is based on a deforestation rate of 2.0 million hectares per year reported in World Bank (2006).

density of forest which may be cleared, which is stipulated as 5 cubic metres per hectare of trees with greater than 10 centimetre diameter. As noted previously, until these investigations began, this regulation had been almost universally ignored, as the accepted practice has been to develop concessions in forested areas. Although the ultimate outcome of the investigations is still not clear, the short-term result has been averted natural forest clearance, as the companies have sourced much of their fibre from plantation wood. In order to do so, however, the companies have been reported by NGO officials to be utilising wood from plantations as young as 5 years old.[14] If this is the case, and government officials do not enforce or enact penalties for clearing of natural forest areas, it is possible that the increased fibre shortfalls that will result in 2008 and 2009 may be bridged with additional natural forest fibre.

CIFOR might have contributed indirectly to this investigation, as NGO officials involved in advocacy that utilised CIFOR's findings have reported that they have fed information to the Riau police. At the same time, this is a protracted impact pathway with uncertain ultimate effects on natural forest clearance. For this reason, it has not been included in the present analysis.

More broadly, although CIFOR did not directly drive the adoption of the Equator Principles or other high-profile environmental commitments by financial institutions, according to both NGO and financial sector informants CIFOR's research has helped to focus increased attention on the possible risks and environmental effects of potential forestry investments in subtle, but important ways. Attention to pulp and paper issues continues to proliferate in the NGO community. New networks (such as the Community Alliance on Pulp and Paper Advocacy), projects (such as Eyes on the Forest), and websites (such as pulpmillwatch.org) continue to emerge to scrutinise developments in the pulp sector, both in Indonesia and across the globe. It is very likely that this has reduced environmental externalities from new potential projects elsewhere.

More generally, key NGO informants report that they have improved their techniques, partially as a result of experience with advocacy as a result of CIFOR's research. Both WWF and FoE representatives report that their organisations pay increased attention to the generation of credible evidence for advocacy, and in some cases have even begun to fund academic research. Such a shift may not only help to make advocacy more effective, but may improve the quality of information generated for policy discussions.

10.3 Nature of economic benefits assessed

The benefits generated principally result from improved levels of nonmarket environmental services, which contribute to the environmental sustainability mandate of CIFOR and the Consultative Group on International Agricultural

[14] Unfortunately, the most recent data available to the author on forestry plantation development did not include the consequences of premature harvesting, so they could not be incorporated into the quantitative estimates of the effects of accelerated plantation development.

Research (CGIAR). Remarkably few studies have documented the environmental benefits of international research, either within or beyond the CGIAR system. A recent initiative to document the impact of natural resources management research by the CGIAR centres (Waibel and Zilberman 2007) focused primarily on analysis of productivity benefits in economic terms. Thus, the present study is rather unique.

Given that quantified benefits arise from one country, this case may appear somewhat incongruous with CIFOR's mandate to produce research with international public goods (IPGs) characteristics, as a centre funded by the CGIAR (Ryan 2006). However, this case actually poses an interesting challenge to how IPG-oriented research should be defined. The research itself focused on activities by specific actors within a specific locality, yet it mobilised a global coalition of actors to advocate for change. Although there have been important influences stemming from this coalition across the globe, the principle product of those efforts, with quantifiable benefits that can be relatively reliably attributed to CIFOR, has been improvement within the original study site. However, the benefits stemming from such improvement principally relate to protection of the earth's climate, which is a textbook example of a global public good.

Moreover, these global environmental benefits are likely to be poverty relevant, as analyses suggest that the poor in developing countries are likely to be the group that is most adversely affected by climate change (IPCC 2007). Agricultural productivity in many tropical and subtropical regions is likely to fall as a result of decreased water availability and increased pest incidence. These effects are likely to be particularly pronounced in rainfed marginal agricultural systems, which are also likely to be particularly vulnerable to increased climatic variability. In some such cases, yields are expected to fall by as much as 50%. In other areas, as water tables rise and flooding increases, disease incidence will rise markedly. As a result, it is widely perceived that climate change will most adversely affect the poorest regions. Thus, the averted carbon emissions that comprise the bulk of the benefits assessed generate environmental benefits that are important to the welfare of the poor.

It should be noted that there are few negative consequences likely to be associated with the environmental benefits assessed in this study. Although reductions in excess forest clearance may result in less land available for encroachment by subsistence agriculturalists, this is a minor proportion of the averted clearing, as much of the averted natural forest clearance is in peatland or land that is otherwise of low productivity and inaccessible. When the forest is clearcut, swidden agricultural productivity is likely to be poor, as there is limited plant material to provide nutrients for the intended annual crop. Thus, forested, rather than cleared, areas are generally favoured for agricultural encroachment (Levang personal communication). Moreover, in the absence of tenure, the practices prevalent in areas of invasion are frequently transient and involve few inputs (Scholz 1985). Overall, the land value lost, as approximated by willingness to pay for 'rental rates', is very low.

While it may first appear that the forest conservation effects assessed have been generated at the expense of the development of the pulp and paper industry and the employment generated thereby, this is not likely to be the case in reality. The net effect of forest conservation is to accelerate plantation development in areas within the 8 million hectares of unproductive grasslands invaded by *Imperata cylindrica* and other noxious weeds. In so doing, employment effects are likely to be positive, given that plantation-sourced fibre requires more labour per unit of production than does clearing of natural forest. Moreover, given very short rotation times and low local labour costs, the cost of plantation-based fibre in Indonesia is among the lowest in the world. This means that the pulp and paper industry should be able to remain competitive without clearing natural forest for fibre, and should be able to offer greater employment in the process. Given the finite forest area within the companies' concessions, it would also appear that although there may be some costs to the profitability of the companies in the short term to invest in plantation-based fibre supplies, this investment is necessary to ensure adequate supplies in the future.

10.4 Implications for future research

While this study finds substantial impact attributable to the assessed research, it must also be recognised that the assessed research took place at a unique and fortuitous time. The fall of the Suharto regime in 1998 enabled a much more open discussion of Indonesia's forestry problems than was previously possible under the 'New Order' regime. The onset of the research as the Suharto regime fell also meant that alternative sources for the information and data that the research provided were not yet available. The timing of the research's release just as APP began to struggle to deliver on its debt obligations meant that much attention was devoted to the company and the sector as the findings became available. All of these conditions created a very receptive climate for the advocacy that built upon the research. Given that the NGOs have subsequently begun to undertake more research of a similar nature, and that the unique salience provided by APP's suspension of debt repayment has since subsided, simple extrapolation of these past patterns of impact to present or future research on similar topics may not be possible.

However, the case does reveal other more general insights about factors that can contribute to policy influence. The case reveals that the primary immediate audience that utilised the work consisted of civil society groups, rather than the public sector – which was the originally intended primary audience. This accords with previous observations that receptiveness to evidence among decision makers depends largely on whether findings correlate with prior beliefs and actions (Janis and Mann 1979).

As advocacy progressed, a number of coalitions emerged among these groups, including the Indonesian Working Group on Forest Finance and Eyes on the Forest, as well as virtual communities, including Pulpmillwatch, APPwatch and APRILwatch. Each of these coalitions shares a core set of beliefs about

Indonesian pulp operations, which CIFOR's research helped to substantiate, by providing data for effective advocacy. Such a pattern aligns with the postulations of the 'policy advocacy coalition framework' that coalitions form among policy makers, influential actors and advocacy group members with a shared 'belief system', and that these beliefs are 'susceptible to change on the basis of scientific and technical analysis' regarding specific details (Jenkins-Smith and Sabatier 1993). In the present case, although this core 'belief system' predated CIFOR's findings, the coalitions were assisted with evidence that allowed more effective arguments to be made, and competing claims to be refuted. In turn, this both provided additional impetus for the formation of coalitions, and helped to empower their advocacy relative to that of the pulp industry. In so doing, the present case offers some potential examples of how policy oriented research can improve practices in a weak governance context. In contexts where appropriate policies and safeguards are not regularly enforced, civil society has frequently taken on a *de facto* governance role, through measures such as codes of conduct and environmental labelling (Mayer and Gereffi 2006). When this is the case, the most relevant immediate audience for policy oriented research findings may be civil society and other private sector governance bodies. Moreover, in many cases where research results contravene the interests or beliefs of government policy makers, there are likely to be civil society groups with more closely aligned positions that could be informed or substantiated by the findings.

At the same time, the case also illustrates some of the potential limitations of such an approach. While NGOs can negotiate and foster incremental improvements in the behaviour of companies that participate in markets where corporate social responsibility yields potential price premiums, fundamental policy perversions often remain (such as the $3.4 billion dollars of losses in the present case). This means that private sector governance can often only incrementally reduce problematic practices through voluntary measures. Moreover, while demands for corporate social responsibility are rising in developed countries, there is limited ability to leverage companies that target other markets. In addition, if research aligns too closely and too frequently with the interests of certain advocates, the credibility of the researchers and their institutes may ultimately be undermined. This places limits on the degree to which such a strategy can be applied.

The case also illustrates that influence on even a rather limited set of policies and associated practices can involve many intermediate pathways. In this case, the changes quantitatively assessed (which are a subset of all of the research's impact pathways) involved, as intermediaries, a wide range of NGOs, bilateral and multilateral donors, a consortium of private sector financiers, as well as Indonesian Government agencies. This has important implications for both research targeting and impact assessment. For the former, it means that a wide variety of potential users may need to be targeted to foster successful influence on even a limited set of policies. For the latter, this poses assessment challenges, as impact assessors of policy oriented research may need to investigate influence along a wide array of pathways in order to capture contribution to subsequent changes.

11 Conclusion

The present study has explored a case example of policy oriented research contribution to improved environmental benefits. By using a semistructured interview approach to trace connections between the research, immediate users and actors 'on the ground', the study is able to establish causality relatively rigorously. Triangulation through document review has helped to validate these causal theories, and trend series statistical tests have further reinforced the concurrence of identified changes with the availability of CIFOR's findings. Counterfactual scenarios are established to draw these findings together into explicit postulates about what would have occurred without the research, upon which empirical quantitative analysis of resultant changes and their economic significance is successfully performed.

This triangulated mixture of qualitative and quantitative methods and economic analysis of attributable changes may offer a valuable example of how a greater array of policy oriented research impacts may be assessed in the future. At the same time, this case was enabled by the fact that advocacy has led to a 'paper trail' of specific commitments and public reporting on practices related to those commitments, which enabled triangulation of interview results, and facilitated quantitative assessment of impact. Impact assessment of policy oriented research in the absence of such information would be considerably more challenging.

The present case study finds likely returns that exceed those most commonly documented for agricultural research successes, and thereby contravenes prior findings from the political science literature, which suggest that policy oriented research is likely to be of limited efficacy in driving improved practices in a short to medium timeframe. In fact, the benefits estimated under the main scenario from this relatively minor research undertaking (with under $400 000 of direct costs) are roughly equal to CIFOR's entire budget for the last decade. Thus, although there is considerable uncertainty regarding a number of the parameters involved, these indicative results offer an illustrative example of how contribution to improvements regarding policies with large social costs, even if relatively minor, can have very large benefits.

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Annex I
List of informants interviewed

Non-Governmental Organizations

Conservation International
Justin Ward, Vice President, Business Practices
Dick Rice, Chief Economist

Down to Earth
Liz Chidley, Campaigner

WWF
WWF Indonesia
Nazir Foead, Species Program Director
Michel Steuwe, Independent Consultant
WWF US
Bruce Cabarle, Director of Global Forest Programs

Friends of the Earth
Friends of the Earth England, Wales and Northern Ireland
Ed Matthew, Head of New Economics
Friends of the Earth Finland
Otto Miettinen, Campaigner
WALHI (Friends of the Earth Indonesia)
Longena Ginting, former Executive Director of WALHI (currently with Friends of the Earth International)
Patrick Anderson, International Campaigns Advisor
Rully Syumanda, Forests Campaigner

Academia

Chatham House
Jade Saunders, Associate Fellow

International Institute for Environment and Development (IIED)
Maryanne Grieg Grann, Programme Director, Environmental Economics

Governmental

European Union Forest Law Enforcement Governance and Trade Initiative
Neil Scotland (formerly with the European Union's Directorate General for Development; currently with Fortis Bank)

Indonesian Ministry of Forestry
Wahjudi Wardojo, former Secretary General of the Ministry of Forestry (currently Director General of the Forestry Research and Development Agency)
Togu Manurung, Advisor to the Minister of Forestry

US Treasury
Keith Kozloff, Senior Environmental Specialist for International Affairs

World Bank Group
World Bank Indonesia
Tom Walton, former Lead Regional Coordinator for the Environmentally and Socially Sustainable Development Department
Tim Brown, Senior Natural Resources Specialist
World Bank Headquarters
Nalin Kishor, Natural Resource Economist

International Finance Corporation
Ole Sand, Principal Investment Officer Forest Products
Richard English, Senior Environmental Specialist
Peter Neame, Principle Environmental Specialist
Mark Constantine, Consultant

UK Department for International Development
John Hudson, Senior Forestry Advisor

Pulp Industry

APRIL
Neil Franklin, Director of Environmental Sustainability
Johnathon Wootliff, Civil Society Engagement Consultant

APP
Canecio Munoz, Director of Sustainability

Private Sector Finance Officials

Citibank
Juhani Numminen, former Vice President, Citibank (currently Senior Advisor, Pulp, Paper and Forest Industries, European Bank of Reconstruction and Development)

HSBC
Francis Sullivan, Deputy Director Sustainable Development

Sustainable Finance
André Abadie, Director (former Head, Sustainable Business Advisory Services, ABN-AMRO)

Investment in policy oriented research is rising despite uncertainties about the degree to which it has actually contributed to benefits for the poor and the environment thus far. To address these uncertainties, this *Impact Assessment Paper* explores a case example of the contribution of policy oriented research to improved environmental benefits. The subject of the assessment is political economy research that revealed how perverse incentives led to the clearance of large areas of natural forests for feeding massive Indonesian pulp mills.

A semistructured interview approach is used to trace connections between the research, immediate users and actors 'on the ground', which enables the establishment of causality. Triangulation through document review helps validate these causal theories, and trend series statistical tests further reinforce the concurrence of identified changes with the availability of CIFOR's findings. Counterfactual scenarios are established to draw these findings together into explicit postulates about what would have occurred without the research, upon which empirical quantitative analysis of resultant changes is performed.

An economic surplus framework is developed to value the nonmarket benefits of averted natural forest clearance attributable to CIFOR's research. These benefits, which principally result from reduced carbon emissions, are determined to range from $19 million to $583 million, depending on assumptions used, with a main estimate of $133 million (discounted US dollars). In the context of less than half a million dollars of direct research costs, this represents an exceptional return on investment.

IMPACT ASSESSMENT PAPERS

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